Information Technology Governance and Innovation Adoption in Varying Organizational Contexts

Mobile Government and Software as a Service

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Abstract

This cumulative dissertation contributes to the question of the theoretical relationship between information technology (IT) governance and the adoption of IT-based innovations. IT governance has been described specifically as the locus of responsibility for IT functions within organizations. Innovation adoption in this context refers to the decision of an organization to make use of a technological innovation. Two principal research questions (RQ) guide this dissertation: (1) how does the mode of IT governance influence adoption of new technologies, and conversely (2) how does the adoption of new technologies affect organizational IT governance?

In order to address RQ1, I conducted four studies in a public sector context regarding innovations in Mobile Government (M-Government) referring to the use of mobile technology to improve government services and internal processes. In a survey with 50 German municipalities, I investigated the strategic motivations for adopting a broad range of emerging M-Government services. The results indicate that municipal governments take a different pace in IT-based innovation adoption and therefore can be described by clusters of "Innovators", "IT experienced", "Efficiency-oriented" and "Laggards" (Chapter 4.1). By an in-depth analysis of interview data from 12 municipalities, I derive a well-grounded framework of drivers and inhibitors of M-Government adoption. Furthermore, based on cross-case analysis, I provide empirical evidence that the mode of IT governance—more precisely, the question of whether responsibilities for IT and organization are effectively aligned—is a crucial prerequisite to foster innovation adoption in public sector organizations. The findings also show why most municipalities focus on *internal* M-Government innovations (Chapter 4.2). For this reason, I examined M-Government adoption on the citizen level in a survey with more than 200 participants. The model tests indicate that *external* M-Government services, such as urban sensing, are also effective means to enable more citizen participation, while perceived privacy risks are not major inhibitors (Chapter 4.3). Finally, applying a simulation approach and a case validation, I demonstrate that such services can improve a municipality's level of environmental information at comparable cost to internal information acquisition procedures and—in this sense—simultaneously allow for implementing service and process innovations (Chapter 4.4).

Regarding RQ2, I consider the adoption of enterprise Software as a Service (SaaS). In this context, it is hypothesized that for some applications SaaS-based provision leads to a 'governance shift' of IT responsibilities from IT towards business units. Based on an in-depth analysis of four cases of SaaS adoption, I take a multiple-contingency perspective to isolate the factors that potentially influence the allocation of application governance (Chapter 5.1). An operationalization and test of the proposed contingency model in a survey with 207 large firms reveals, that responsibility for SaaS-based applications is indeed allocated more frequently to business units. Drawing on multiple theoretical perspectives, this can be (partly) explained by a smaller scope of the use of SaaS-based applications and the changing competency requirements for SaaS-based delivery. However, the locus of the initiative emerges as the most determining factor for explaining application governance (Chapter 5.3). Recognizing the inherent limitations of a factor-based approach, two cases of SaaS adoption are compared in detail by applying a process-theoretic paradigm. Here the

locus of initiative emerges as an intermediate variable that links the mode of overall IT governance with the specific application governance outcome (Chapter 5.3). Such process view is taken as a premise to analyze the role of information system specificity for SaaS governance. In a subsample test for SaaS applications, I am able to unveil that the functional, human and technological specificity of a SaaS have a *dual* influence on the locus of application governance (Chapter 5.4).

In summary, this dissertation sheds light on the question of how IT governance and its mechanisms can foster innovativeness in certain contexts (e.g., through aligning IT responsibilities in public sector organizations), and conversely how the mode of IT governance itself can be shaped by the emergence of new technological innovations (e.g., external delivery models such as SaaS). These findings enhance ‘classic’ IT governance theory by providing new insights on the mutual relationship of IT governance and IT innovation and thus corroborate the complementarity of organizational and technological architecture. Methodologically, this work demonstrates the richness provided by alternating between qualitative and quantitative empirical approaches. Finally, a number of relevant practical implications for IT decision makers in governmental and entrepreneurial contexts are outlined.

Keywords: Information Systems, IT Governance, IT Innovation, IT Adoption, Mobile Government, E-Government, Software as a Service, Empirical studies, Multimethod research.

Zusammenfassung

Diese kumulative Dissertation leistet einen Erklärungsbeitrag zu der Frage der theoretischen Beziehung zwischen der *IT-Governance* und der *Adoption* von IT-basierten Innovationen auf Organisationsebene.[1] IT-Governance kann in diesem Zusammenhang als der Ort der Verantwortungshoheit für IT-Entscheidungen verstanden werden. Adoption bezieht sich auf die Aneignung einer technologischen Innovation durch eine Organisation. Zwei übergeordnete Forschungsfragen leiten diese Dissertation: (1) Wie beeinflusst die Form der IT-Governance die Aneignung neuer Technologien, und umgekehrt (2) wie beeinflussen neue Technologien die Form der IT-Governance?

Hinsichtlich Forschungsfrage (1) wurden vier Studien zu Innovationen im Mobile Government (M-Government) durchgeführt, d.h. zu der Nutzung von mobilen Technologien im öffentlichen Sektor mit dem Ziel Verwaltungsdienstleistungen und interne Prozesse zu verbessern. In einer Studie mit 50 deutschen Stadtverwaltungen wurden die strategischen Motivationen untersucht, die zur Annahme (oder Ablehnung) eines breiten Spektrums an neuartigen M-Government-Diensten führen können. Die Ergebnisse deuten darauf hin, dass öffentliche Verwaltungen einen unterschiedlichen Grad der Aneignung IT-basierter Innovationen aufweisen und sich somit in Cluster von "Innovatoren", "IT-Erfahrenen", "Effizienz-orientierten" und "Laggards" einteilen lassen (Kapitel 4.1). Aus der detallierten Analyse von Interviews mit 12 städtischen IT-Entscheidern wird darauf ein gegenstandsverankertes Rahmenenwerk von Treibern und Hindernissen für das M-Government entwickelt. Im Rahmen von Fallvergleichen zeigt sich zudem eine empirische Evidenz dafür, dass die Form der IT-Governance – genauer, die Frage ob Verantwortlichkeiten für IT sowie Organisation und Personal effektiv miteinander verbunden sind – eine wesentliche Voraussetzung für die Umsetzung von IT-Innovationen darstellt. Die Ergebnisse zeigen auch auf, warum sich viele Städte bisher auf *interne* M-Government Anwendungen konzentrieren (Kapitel 4.2). Aus diesem Grund wird in einer Studie mit über 200 Teilnehmern die Akzeptanz für einen M-Government-Dienst auf Ebene des Bürgers analysiert. Modelltests zeigen, dass *externe* M-Government-Dienste, wie z.B. solche der urbanen Datenerfassung (Urban Sensing), einen probaten Weg zu mehr Bürgerbeteiligung ermöglichen, wohingegen Datenschutzbedenken auf Nutzerseite kein wesenliches Hindernis darstellen (Kapitel 4.3). Schließlich wird durch einen Simulationsansatz und der Validierung in einer Fallstudie demonstriert, dass externe M-Government-Dienste den Informationsgrad von Verwaltungen erhöhen können bei vergleichbaren Kosten zu der internen Informationsgewinnung – und somit gleichzeitig Dienstleistungs- und Prozess-Innovationen erzielt werden können (Kapitel 4.4).

In Bezug auf Forschungsfrage (2) wurde die Aneignung von Unternehmenssoftware *as a Service* (SaaS), d.h. die Nutzung von Geschäftsanwendungen als webbasierte Dienste, untersucht. In diesem Zusammenhang wird hypothetisiert, dass die SaaS-basierte Bereitstellung für einige Anwendungen zu einer Verschiebung der IT-Verantwortlichkeiten von IT-Abteilungen zu Fachbereichen führt. Basierend auf vier Fallstudien wird zunächst ein kontingenzbasierter Ansatz gewählt, um solche Faktoren zu isolieren, die einen potenziellen Einfluss auf die Verteilung der Anwendungs-

[1] IT: Informationstechnologie

hoheit haben (Kapitel 5.1). Eine Operationalisierung und Tests des vorgeschlagenen Kontingenzmodells in einer Studie mit 207 Großunternehmen zeigen auf, dass die Verantwortung für SaaS-baasierte Anwendungen tatsächlich häufiger Fachabteilungen zugeordnet ist. Bezug nehmend auf mehrere theoretische Perspektiven kann dies (zum Teil) durch einen geringeren Nutzungsumfang von SaaS-basierten Anwendungen in Unternehmen sowie durch sich verändernde Kompetenzanforderungen für das SaaS-basierte Anwendungsmanagement erklärt werden. Als am stärksten ausschlaggebender Faktor tritt jedoch der Ursprung der Initiative der SaaS-Einführung hervor (Kapitel 5.2). In Anerkennung der methodeninhärenten Einschränkungen eines faktorbasierten Vorgehens werden zwei Fälle von SaaS-Einführungen unter Verwendung eines prozesstheoretischen Ansatzes analysiert. Der Ursprung der Initiative zeigt sich hierbei als intermediäre Variable, die den Modus der übergreifenden IT-Governance mit dem konkreten Resultat auf Anwendungsebene kausallogisch verbindet (Kapitel 5.3). Eine solche Prozesssicht dient ebenfalls als Prämisse um die Rolle der Informationssystem-Spezifität auf SaaS-Governance (d.h. die Anwendungshoheit) zu untersuchen. Ein Test der Stichprobe für SaaS-Anwendungen deckt auf, dass die funktionale, personelle und technologische Spezifität eines SaaS-Informationssystems einen *dualen* Einfluss auf den Ort der Verantwortungshoheit ausübt (Kapitel 5.4).

Zusammenfassend gibt diese Dissertation Aufschluss darüber, wie IT-Governance und entsprechende Mechanismen die Innovativität in bestimmten organisationalen Kontexten begünstigen können (in öffentlichen Verwaltungen z.B. durch die Verknüpfung von bestimmten IT-Verantwortlichkeiten) und umgekehrt wie die Form der IT-Governance selbst durch das Aufkommen von technologischen Neuerungen (z.B. durch externe Bereitstellungsmodelle wie SaaS) umgestaltet wird bzw. werden muss. Diese Ergebnisse erweitern die ‘klassische’ IT-Governance-Theorie durch neue Erkenntnisse bezüglich des wechselseitigen Verhältnisses von IT-Governance und IT-Innovation, wodurch die Komplementarität zwischen der organisatorischen und der technologischen Unternehmensarchitektur untermauert wird. Methodisch demonstriert diese Arbeit den Reichtum, der durch den wechselnden Einsatz von qualitativen und quantitativen Ansätzen erzielt werden kann. Abschließend werden eine Reihe von Implikationen für IT-Entscheider in öffentlichen und privatwirtschaftlichen Kontexten aufgezeigt.

Schlüsselwörter: Wirtschaftsinformatik, IT-Governance, IT-Innovation, IT-Adoption, Mobile Government, E-Government, Software-as-a-Service, Empirische Studien, Multimethodaler Ansatz.

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Contents

1 Introduction **1**

1.1 Mobile Government . . . 5
1.2 Software as a Service . . . 7
1.3 Thesis Structure . . . 9

2 Foundations of IT Governance and Organization Design **13**

2.1 Preamble . . . 13
2.2 Introduction . . . 13
2.3 Six Dimensions of IT Organization Design . . . 14
2.3.1 Allocation of IT Decision Rights . . . 14
2.3.2 Allocation of IT Resources . . . 15
2.3.3 Coordination Mechanisms . . . 16
2.3.4 Financial Autonomy . . . 17
2.3.5 Sourcing Arrangements . . . 18
2.3.6 Capabilities and Skills . . . 19
2.4 IT Organization Archetypes . . . 20
2.4.1 Centralized Model . . . 20
2.4.2 Decentralized Model . . . 21
2.4.3 Shared Services Model . . . 22
2.4.4 Corporate Coordinator Model . . . 23
2.5 Motivation for Further Research . . . 24
2.6 Summary . . . 27

3 Methodological Foundations **29**

3.1 Epistemological Preamble . . . 29
3.2 Qualitative Methods . . . 31
3.2.1 Interviews . . . 31
3.2.2 Content Analysis . . . 31
3.2.3 Grounded Theory . . . 32
3.2.4 Case Studies . . . 33
3.3 Quantitative Methods . . . 35
3.3.1 Survey . . . 35
3.3.2 Structural Equation Modeling . . . 36
3.3.3 Clustering and Subgroup Analysis . . . 38
3.3.4 Simulation . . . 39

4 IT Governance and Innovation Adoption in E-Government 41
4.1 Innovations in Mobile Government . . . 41
4.1.1 Preamble . . . 41
4.1.2 Introduction . . . 41
4.1.3 Theoretical Foundations and Hypotheses Development . . . 42
4.1.4 Qualitative Pre-Study . . . 46
4.1.5 Empirical Study . . . 48
4.1.6 Model Tests and Results Discussion . . . 50
4.1.7 Conclusion . . . 57
4.1.8 Summary . . . 59
4.2 Towards Transformational IT Governance . . . 60
4.2.1 Preamble . . . 60
4.2.2 Introduction . . . 60
4.2.3 Related Work . . . 61
4.2.4 Research Method . . . 62
4.2.5 Framework for Mobile Government Adoption . . . 64
4.2.6 Mobile Government Cases . . . 68
4.2.7 Conclusion . . . 73
4.2.8 Summary . . . 75
4.3 Citizen Acceptance in Urban Sensing . . . 76
4.3.1 Preamble . . . 76
4.3.2 Introduction . . . 76
4.3.3 Theoretical Foundations and Model Development . . . 77
4.3.4 Methodology . . . 82
4.3.5 Model Analysis and Discussion . . . 83
4.3.6 Conclusion . . . 87
4.3.7 Summary . . . 89
4.4 Municipal Benefits of Urban Sensing . . . 90
4.4.1 Preamble . . . 90
4.4.2 Introduction . . . 90
4.4.3 Related Work . . . 91
4.4.4 Research Method . . . 96
4.4.5 Simulation Model . . . 99
4.4.6 Case Validation . . . 103
4.4.7 Conclusion . . . 112
4.4.8 Summary . . . 115

5 Innovation Adoption and IT Governance in Enterprise Information Systems 117
5.1 The Impact of Software as a Service on Information Systems Authority . . 117
5.1.1 Preamble . . . 117
5.1.2 Introduction . . . 117
5.1.3 Theoretical Foundations . . . 118
5.1.4 Research Methodology . . . 121

5.1.5 Results – A Contingency Model for Application Governance 123
5.1.6 Comparative Case Studies 130
5.1.7 Conclusion 135
5.1.8 Summary 137
5.2 Comparing Authority for On-Premises Applications and SaaS 138
5.2.1 Preamble 138
5.2.2 Introduction 138
5.2.3 Three Theoretical Lenses on Application Authority 140
5.2.4 Research Model and Hypotheses 142
5.2.5 Methodology 151
5.2.6 Analysis 156
5.2.7 Discussion 160
5.2.8 Summary 164
5.3 A Process Model for Explaining Governance of Software as a Service . . . 165
5.3.1 Preamble 165
5.3.2 Introduction 165
5.3.3 Related Work 166
5.3.4 A Process Model for SaaS Adoption and Governance 168
5.3.5 Empirical Illustration of the Process Approach: Two Cases 170
5.3.6 Conclusion 177
5.3.7 Summary 178
5.4 The Dual Role of Information Systems Specificity for Governing SaaS . . 180
5.4.1 Preamble 180
5.4.2 Introduction 180
5.4.3 Theoretical Lens 182
5.4.4 Research Model 183
5.4.5 Methodology 190
5.4.6 Analysis 191
5.4.7 Discussion 197
5.4.8 Summary 202

6 Conclusion and Contributions 203
6.1 Theoretical Contribution: On the Relationship of IT Governance and Innovation 204
6.2 Practical Contribution: Reflections on IT Governance in Public and Private Sector 207
6.3 Methodological Contribution: On the Use of Multimethod Research . . . 210
6.4 Limitations and Future Research 214

Appendices 217
1 M-Government Survey with German Municipalities (Online) 217
2 Citizen Acceptance Survey (Online) 229
3 Urban Sensing Simulation Model (Scripts) 237
4 Workshop Documentation (Excerpt) 239

5 SaaS Interview Guideline (Shortened) 243
6 Business and Information Technology Survey (Supplements) 245
6.1 Cover Letter 245
6.2 Questionnaire 247
6.3 Sample Description 257
7 SaaS Adoption Processes (Enlarged) 265
8 Information Systems Specificity (Items and Cross-loadings) 269

Bibliography **271**

List of Figures

1.1 Principal research questions and definitions 4

2.1 IT organization archetypes 16

3.1 Grounded theory elements 33

4.1 Research model 44
4.2 Sample description 50
4.3 Structural model results 55
4.4 Mean factor scores per municipality cluster 56
4.5 Interview sample description 62
4.6 Adapted coding paradigm from Strauss and Corbin (1998) 64
4.7 Framework for m-government adoption 65
4.8 Research Model 78
4.9 Respondent age and occupation 83
4.10 Structural model results 86
4.11 Field of research 93
4.12 System Dynamics syntax 95
4.13 Build, evaluation, intervention cycles 97
4.14 System dynamics representation 99
4.15 Complaint and defect management process and selected subprocesses . . . 104
4.16 Survey results 106
4.17 Simulation results 109
4.18 Estimated and actual adoption curves 111

5.1 Adapted coding paradigm from Glaser (1992) 123
5.2 Contingency model for application governance 124
5.3 Research model 142
5.4 Application governance patterns 157
5.5 Model tests and subgroup analysis 158
5.6 SaaS adoption processes (overview) 175
5.7 Interrelationship of application governance factors 176
5.8 Research model 184
5.9 Multidimensional visualization of application types 197

1 Survey reminders and response distribution 259
2 Respondent work years and position 261

3 Manufacturing vs. service industries 262
4 Physical vs. informational products 262
5 Business to consumer vs. business to business 262
6 Employee firm size 263
7 Financial firm size 263
8 Histogram of IT employees and IT budget 264
9 Position of the CIO 264
10 SaaS Adoption Process – Case B 266
11 SaaS Adoption Process – Case C 267

List of Tables

1.1 Thesis structure . . . 9
1.2 Overview of publications . . . 11

2.1 Organizational design dimensions . . . 20
2.2 Key characteristics of four IT organization archetypes . . . 25

3.1 Overview of research methods . . . 35

4.1 Interviewees and city sizes . . . 46
4.2 Operationalization of antecedent factors . . . 48
4.3 Descriptive results of service attractiveness . . . 51
4.4 Tolerance values of formative indicators . . . 52
4.5 Convergent validity criteria . . . 53
4.6 Discriminant validity criteria . . . 54
4.7 Municipality clusters and group differences . . . 57
4.8 M-government service outcomes . . . 67
4.9 M-government cases overview . . . 70
4.10 Contingencies for m-government adoption and target groups . . . 73
4.11 Measurement instrument, descriptive statistics and reliabilites . . . 84
4.12 Convergent and discriminant validity criteria . . . 85
4.13 Simulation model parameters . . . 108
4.14 Qualitative aspects of introducing mobile reporting . . . 110

5.1 Case companies and key figures . . . 122
5.2 Contingency factors and proposed influence on application governance . . . 129
5.3 Case comparison and contingent forces . . . 132
5.4 Comparison of induced and present governance mode . . . 134
5.5 Hypotheses overview . . . 150
5.6 Application types and sample distribution . . . 153
5.7 Validity criteria . . . 155
5.8 Results of the hypotheses tests . . . 160
5.9 Case key figures . . . 171
5.10 Measurement model validity . . . 192
5.11 Model tests . . . 193
5.12 Application types . . . 196

6.1 Contributions to IT governance theory . . . 208

6.2 Multimethod research overview . . . 211

3 Industry classification . . . 260
4 Respondent industries . . . 260
5 Items and cross-loadings . . . 269

1 Introduction

Innovation is the primary source of competitive advantage for companies and the basis of economic development (Schumpeter 1926; Burns and Stalker 1966; Acemoglu 2012). Most organizations, both in the public and private sector, constantly face the challenge to innovate, i.e. to bring out novel products or services as well as to improve internal processes in order to compete on the external market and increase productivity (Utterback and Abernathy 1975; von Hippel 1988). Information technology (IT) today plays a pivotal role in organizational innovation adoption (Acemoglu 2012). Hardly any product, service or process innovation can succeed without being supported, if not enabled, by IT (Davenport 1993). For example, in the last decade public sector agencies worldwide have dedicated much effort to bringing government services online to the Internet, a development that has been widely termed as Electronic Government (UN 2012). In addition, in the private sector most enterprises have implemented centralized repositories for customer data to facilitate customer relationship management (CRM) processes and exploit market opportunities (Chen and Popovich 2003; Kumar et al. 2011).

Obviously, what is an IT-based product or service innovation for one party (i.e., the vendor or provider) may represent a process innovation for the other (i.e., the client or user organization). In this sense, public agencies that bring out new E-Government services enable their customers to innovate in the process of interaction with their government. Or regarding the second example, companies that use vendor solutions to support their CRM processes, benefit from the product innovation brought out (earlier) by this vendor. Therefore, it is not the mere investment and the adoption of IT innovations that creates value—as the early literature on IT value suspected when trying to resolve the 'IT paradoxon' (e.g., Brynjolfsson 1993; Triplett 1999). Rather, IT-based innovations create value only when the technology itself also fits to the needs of the client and is embedded in the processes of the user organization (Brynjolfsson and Hitt 2000; Soh et al. 2000). This also motivates why adopting IT-based product/service innovations and implementing new technologies in organizations often leads to major organizational change (Keen 1981; Lyytinen and Newman 2008)—because exploiting the opportunities brought about by these innovations often requires a change of the company's (or government's) practices, processes, and culture likewise (Sia and Soh 2007; Strong and Volkoff 2010). For this reason, IT-based innovation adoption may sometimes even entail a transformational impact on organizations and organization structure (Venkatraman 2005; Irani et al. 2008; Winkler et al. 2008).

In a structural view, organizations typically bundle functions that are specialized on planning, designing and operating IT resources for the rest of the organization (i.e., 'the business') in a—however natured—*IT function* (Agarwal and Sambamurthy 2002). The question on how to align the IT function with the business organization, especially on a structural, procedural and relational level, is commonly viewed as the central concern of IT governance (e.g., Brown and Magill 1994; Sambamurthy and Zmud 1999; Schwarz and Hirschheim 2003; Weill and Ross 2004a; Van Grembergen 2004). A crucial, if not the most fundamental, dimension of IT governance refers to the allocation of IT decisions rights in an organization. That is, this dimension focuses on *which* are the major decisions regarding IT management and use and *who* should make them. Given there is a multitude of stakeholders, such decision rights can be both shared horizontally (i.e., between business and IT stakeholders) and vertically (i.e., between C-level, senior level, mid level and staff level) within an organization (Weill and Ross 2004a). Or, in a simplified view (i.e., combining the horizontal and vertical dimensions), IT decision rights are shared between centralized and decentralized groups (Brown and Magill 1994; Sambamurthy and Zmud 1999). In line with the broader organization science literature (Daft 2009), the IT governance literature emphasizes that there is no universal way for designing IT governance. Rather the 'best' way of governing IT functions depends on certain, foremost business-related, contingencies (see Brown and Grant 2005, p. 703, for an overview). For example, it has been confirmed that smaller companies tend to centralize IT governance, while larger companies create more complex federal and decentralized structures. However, as Brown and Grant (2005, p. 704) note, "absent from the list of [contingency] variables is [still] a discussion on technology and technology adoption, where surprisingly, little to no research was found".

In practice, companies that struggle with a lack of innovativeness often ask who should be responsible for IT-based innovations, business or IT units? (e.g., Power 2012). Having argued that IT-based innovations create value only when they become part of the organization's work routines, it becomes apparent that the adoption of IT-based innovations is a key governance issue, which requires the integration of both business and IT stakeholders. However, we may still ask to which degree of involvement this should happen. Regarding the relationship of IT innovation and IT governance, the literature provides the rationale of a strategy-structure fit (Brown and Grant 2005, p. 204). That is, firms that seek competitive advantage primarily through differentiation (i.e., by product and service innovations) tend to decentralize IT governance structures in order to sustain technological responsiveness to the needs of internal (and external) customers. Conversely, firms that follow a cost leadership strategy tend to centralize IT governance in order to leverage internal economies of scale (Weill and Ross 2004b).

Nevertheless, the rationale of balancing scale versus responsiveness possesses some inherent limitations. First, it largely focuses on a company's product and service innovations and thus does not inform on how to allocate decision rights for increased *process innovation*—which is often the primary goal of organizational IT use (Davenport and Short 2003). Second, it merely focuses on the business drivers and thus neglects the potential *technology contingencies*. Given the past pendulum swings between centralized and decentralized forms of IT use (Peak and Azadmanesh 1997; Brynjolfsson and Hitt 1998; Evaristo et al. 2005), the mode of governance may also clearly depend on the type of technology that is prevailing (howsoever this technology can be characterized, Orlikowski and Iacono 2001). Third, it largely regards 'the IT' as a *bulk function* for which companies allocate decision rights to ensure overall innovativeness. However, the singularity in the occurrence of IT innovations implies that it may be appropriate to also take a more modular view on IT governance, i.e. depending on the IT artifact that is subject to the IT-based innovation of interest. Fourth, it takes a *unidirectional view* assuming that IT innovation is always the result of strategy and governance structure. However, many IT innovations that enter the enterprise from IT market, i.e. from the vendor side, occur without a defined business demand. Such innovations may conversely also impact the mode of IT governance. Fifth, past research has been largely directed at *enterprise IT governance*, i.e. at the private sector. The rationales for defining appropriate governance arrangement in public sector organizations—in their nature to be non-profit driven—may clearly deviate from this (Weill and Ross 2004a, pp. 185-214; Sethibe et al. 2007). In sum, despite more than two decades of IT governance research (Brown and Grant 2005), we know few about the mutual relationship of IT governance and IT innovations.

This thesis investigates the role of IT governance arrangements in various IT innovation and adoption contexts. The approach taken in this thesis aims to enhance our understanding by building on the extant literature. In particular, it (1) explicitly considers service and process-based IT innovations, (2) explores the technology contingencies of IT governance pertaining to the IT artifact, (3) conceptualizes governance arrangements for different IT sub-functions, and (4) takes a bidirectional view where the emergence of an IT innovation itself may impact the mode of governance and vice versa, (5) across different public and private sector contexts. In the framework of this work, we understand an IT-based innovation as the *benefits that result from adopting and using a new technology in an organization*. Adoption in turn refers to *the decision of (an individual or) an organization to make use of an organization* (Rogers 1962). Overall, this thesis is guided by two principal research questions:

RQ1: *How does the mode of IT governance influence the adoption of new technologies,* and conversely

RQ2: *How does the adoption of new technologies affect organizational IT governance?*

To address these research questions, I consider two distinct IT-based innovations that have recently attracted much attention both in theory and in practice. The first innovation refers to the implementation of Mobile Government (M-Government) services by public agencies, the second to the adoption of enterprise Software as a Service (SaaS). For each of these different contexts of innovation, four separate studies are conducted that combine qualitative, quantitative and design-oriented research methods. Regarding innovations in M-Government, I demonstrate how the strategic framework as well as the mode of IT governance in municipalities has a bearing on their innovativeness, more precisely on the extent and focus to which emerging M-Government solutions are adopted. In an enterprise context I study, how SaaS adoption impacts IT governance and under which circumstances this can lead to a shift of decision rights towards business units. Both research questions are depicted in Figure 1.1

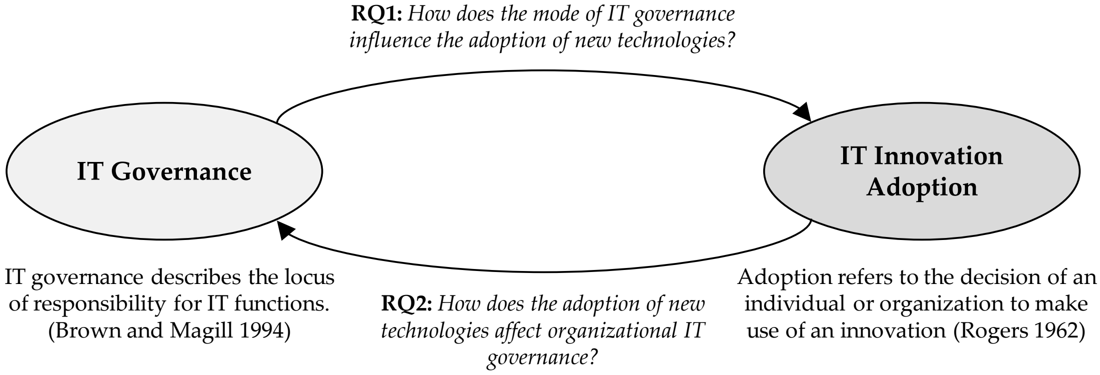


Figure 1.1: Principal research questions and definitions

Furthermore, this thesis also aims to provide concrete practical guidance to foster decision making in diverse innovation contexts. Regarding M-Government adoption, I provide insights into the factors that are important (and those that are *not* important) to achieve citizen acceptance of M-Government services. Finally, taking an action research approach, I describe the case of a municipality where I actively observed the introduction of an M-Government service (i.e., an urban sensing service). In the context of enterprise SaaS, I first propose and validate a contingency model that may inform practitioners when shifts in the governance of an enterprise application may occur. However, acknowledging the limitations of such factor-based approach, I propose a process model to better understand IT governance phenomena in SaaS adoption contexts. Following from this, I finally revisit the empirical data and unveil a new dualism specifically related to the technological and artifact-level contingencies for IT governance arrangements.

Besides the theoretical and practical contributions provided in each of these studies, two important findings emerge from this compound research that extend the classical view of IT governance. First, based on the case evidence on M-Government adoption, it shows that those public agencies which effectively connect (and thus largely *centralize*) decision rights for IT *and* organization succeed in implementing process and service innovations. To some extent, this contradicts the rationale in enterprise IT governance that organizations will be more innovative when *decentralizing* IT governance. I introduce the concept of *transformational IT governance* to account for this proposition and provide a broader discussion of this issue in the conclusion. Second, in the course of the presented studies, I develop a transaction cost theoretic framework to explain (SaaS) application governance phenomena. It becomes apparent that the classic strategy-structure fit and the rationale to centralize IT governance for greater efficiency does not necessarily hold, or may even need to be reverted, for SaaS-based solutions. This finding and the transaction cost theoretic framework are also discussed in the conclusion.

In the following I will briefly motivate the choice of Mobile Government and Software as a Service as two current IT-based innovations, before I explain the thesis structure.

1.1 Mobile Government

Since the late 1990s, Electronic Government (E-Government, also sometimes called Digital Government or Electronic Governance[1]) has emerged as an independent field of research (Grönlund and Horan 2004). E-Government can be defined as *the use of information and communication technology (ICT) in public administrations combined with organizational change and new skills in order to improve public services and democratic processes* (EU 2003). Although the use of IT (or ICT) by governments has been the subject of research of earlier studies (see Anderson and Henriksen 2005), the term E-Government itself has been born in course of the Internet boom (parallel with E-Commerce) primarily by the idea to bring government services online (Grönlund and Horan 2004). It thus represents a comparably interdisciplinary field of research that draws on different related areas such as political science, social science and information systems research (Heeks and Bailur 2007).

Not too long after the emergence of E-Government, the term mobile government (M-Government) was coined to describe such E-Government efforts that include the use of mobile and wireless technologies (Kushchu and Kuscu 2003). The wide recognition of M-government is driven by the penetration of mobile devices and the emergence of the mobile Internet (i.e., mobile broadband networks) (ITU 2010). Mobile government can be defined as *a strategy and its implementation involving the utilization of all kinds of wireless and mobile technology, services, applications and devices for improving benefits to the parties involved in e-government including citizens, businesses and all government units* (Kushchu and Kuscu 2003). Akin to E-Government, different foci of M-Government are usually differentiated depending on the target group of M-Government efforts, i.e. Government-to-Citizen (G2G), Government-to-Business (G2B), Government-to-Government (G2G), Government-to-employee (G2E), and vice versa (i.e., C2G, B2G, E2G).

External (i.e., G2C and G2B) M-government applications may be further classified by whether they provide informational or transactional services. Similar to E-Government, services for information dissemination are generally less problematic, since they enable only unidirectional information flow and thus pose less requirements regarding identification and authentication of the recipient. Early examples for informational M-Government services include disaster notifications, traffic news, or even voting via SMS[2] (Al-khamayseh et al. 2006; Rossel et al. 2006; Trimi and Sheng 2008). Today, an increasing number of cities offer mobile applications (i.e., 'smartphone apps') that provide a variety of information related to living in that city, e.g. public transport schedules, touristic information, refuse collection information, etc. (see Vitako 2011, pp. 10-14,

[1] The terms *government* and *governance* should not be confounded in course of this thesis. While the former (government) is used to refer to the organizational entity of a public agency, the latter is largely used in the context of Information Technology (IT) governance, which is concerned with the set of mechanisms that determine how the IT function is managed and aligned within the wider organizational context.

[2] Short message service

for some examples from Germany). However, *transactional* mobile services, such as online payment services, tax declaration, car registration known from the E-Government domain, are still rare in Mobile Government, as they pose greater integration and security needs (UN 2012, p. 41). The question might even be, whether there is a demand for such services on a mobile channel. Since government transactions (e.g., a tax declaration) typically require longer interaction with an information system, some parties may argue that transactional government services are generally not an appropriate use case for a mobile device.

Internal M-Government applications (i.e., G2G and G2E) are—in the light of this thesis—largely viewed as process innovations (Davenport 1993). That is, by the use of mobile and wireless technology, public agencies can handle internal processes more effectively and efficiently. (For this reason, other authors have also termed this segment of M-Government as 'internal efficiency and effectiveness' IEE, Trimi and Sheng 2008). Examples include the equipping of government staff (especially field workers) such as police, firefighters, and field inspectors with mobile devices to provide them with appropriate information and allow for on-the-spot data processing (Kushchu and Kuscu 2003). This can save valuable time for back-office work, improve data quality, and enable better dispatching, amongst other benefits (Vitako 2011, p. 11). Obviously, the idea of 'internal M-Government' (or IEE) is not entirely new. For example, public safety departments have used wireless communication systems ever since the existence of these tools (Desourdis 2002). However, the proliferation of commercial broadband networks and off-the-shell mobile devices (i.e., mobile phones and tablet PCs) undoubtedly also leads to a new momentum for M-Government in public authorities which are not concerned with public safety. Furthermore, in a wider sense internal M-Government applications may also affect other government workers than those in the field, e.g. when equipping a city hall with local wireless networks and/or enabling teleworking (Trimi and Sheng 2008). The increasing consumerization of IT may also lead government employees to expect those mobile tools in their workplace, that they are used to from their home environments (Bernnat et al. 2010).

Altogether, emerging M-Government solutions represent a broad range of potential innovations in E-Government that may entail benefits for government customers (i.e., citizens and businesses) as well as employees. Although global adoption, diffusion and use of E-Government itself is still far from reaching a final stage (Grönlund and Horan 2004; UN 2012), I regard the subset of M-Government as a particularly interesting research objective to study IT-based innovation adoption. This is mainly for three reasons: First, at the time of writing this thesis M-Government is still a relatively new phenomenon that has been driven by the recent popularity of the mobile Internet and according devices. Second, it exhibits a very cross-disciplinary character involving technical, social and political aspects. And finally, this innovation is situated in the public sector, which—despite the acknowledged goal to create public value—has traditionally been less researched in the IS field (Scholl 2006).

1.2 Software as a Service

The second IT-based innovation considered in this thesis refers to the use of enterprise software *as a Service* (SaaS). In contrast to M-Government, SaaS represents a *delivery model* innovation in the way *how* enterprise software is provided, rather than a concrete bundle of 'new' applications.[3] SaaS refers to the provision of standard software via the Internet from an external provider who serves multiple customers (tenants) by the same instance (Cusumano 2010). Thus, SaaS can be regarded as a special form of application outsourcing (Lee et al. 2003). Compared to traditional enterprise software, which is either hosted on dedicated instances at provider side or installed on the company's own infrastructure (i.e., 'on-premises'), SaaS generally allows for greater economies of scale due to a better utilization of infrastructure resources. Economically, it is often emphasized that with SaaS customers 'rent' software (and the underlying infrastructure resources) instead of buying perpetual-use licenses (Choudhary 2007b; Susarla et al. 2009; Lehmann et al. 2010).

The SaaS model is not an entirely new phenomenon, rather it has evolved from earlier forms of web-based delivery which have been termed as application service providing (ASP) (e.g., Günther et al. 2001; Susarla et al. 2003) or sometimes also 'netsourcing' (Loebbecke and Huyskens 2006). While the borders between ASP and SaaS certainly have been fluent, it is often argued that the distinguishing criterion for SaaS is the multitenancy characteristic, i.e. the capability to serve multiple tenants from a single set of resources (Benlian and Hess 2010a). However, the more determining reason for becoming the accepted term may lie in the commercial breakthrough of the 'SaaS' model, rather than any definitional distinction. In a recent forecast, market researchers predict that by 2015, 13 percent of worldwide software spending will be on SaaS delivery and that 24 percent of all new enterprise software purchases will be of a "service-enabled" software (Mahowald et al. 2011). The main drivers of this commercial success—compared to prior models—have obviously been increasing bandwidths, increasing computing power as well as specific advancements in distributed computing and web development techniques (e.g., rich user interfaces, asynchronous web applications and web service standards) (Sun et al. 2007; Fraternali et al. 2010). Thus, we can say that SaaS and related delivery models today represent the commercial realization of the long-held dream of 'computing as a utility' (Parkhill 1966; Carr 2004).

Extending beyond that, SaaS is now also considered a part of Cloud computing, more precisely as the highest layer of the Cloud computing stack (Armbrust et al. 2010). Cloud computing refers more broadly to the use of *any* kind of computing resource *as a service* (aaS) over the Internet (Hayes 2008).[4] Three main layers of Cloud services are distinguished: infrastructure services (IaaS) that provide computational resources, basic storage and network functionality, platform services (PaaS) that typically provide

[3]Although one may argue that M-Government as well represents a 'delivery model' innovation, in a sense that government services are now delivered via a mobile channel.

[4]Some authors even extend the notion of a 'Cloud' to distributed computing within local area networks. However, an extensive discussion of 'public' versus 'private' clouds shall be omitted here.

a development and execution environment to build software applications from components (e.g., including database, web and application server components), and application services (i.e. SaaS) that comprise web-based applications for enterprise use (Lenk et al. 2009). In this logic, a SaaS may be built on a PaaS and use IaaS, so that the SaaS provider in turn can (but not necessarily has to) become a Cloud user (Armbrust et al. 2010). Altogether, it stands to reason that the increasing 'servitization' of applications and application components leads to entire ecosystems and supply chains of IT service provision that may span an increasing number of providers and different types of services. Today, SaaS is (with more than 50 percent) still by far the largest segment of the entire market of Cloud-based services and is expected to remain at this position in the future (Gens 2008).

The market for SaaS generally covers most of the applications that are also available as traditional enterprise software, e.g. Enterprise Resource Planning (ERP), Supply Chain Management (SCM), Customer Relationship Management (CRM) as well as Content, Communications and Collaboration (CCC) application types (Gartner 2009). However, some applications that are 'web-native', e.g. email, teleconferencing and web-hosting, are obviously more likely to be procured via SaaS than those that require local hardware and integration (e.g., engineering and design, production planning and automation systems). For example, from the four mentioned application types, CCC and CRM applications are much more frequently procured via SaaS than ERP and SCM systems (Gartner 2009). The literature largely explains this by stating that the main drivers for adopting SaaS applications are lower application specificity, lower strategic value, lower uncertainty, and higher imitability (Benlian et al. 2009). Companies foremost expect cost advantages from using SaaS, i.e. a variabilization of fix IT investments by 'renting' software (Choudhary 2007b; Benlian and Hess 2011). On the other hand, greatest inhibitors of SaaS adoption are frequently the security risks from giving data control to an external party, e.g. caused by data theft and data corruption (Xin and Levina 2008; Benlian and Hess 2011).

Altogether, since SaaS has entered the enterprise landscape and companies make experiences in the use of SaaS, the IS literature has provided significant insights about the factors of SaaS adoption. More recently, some authors have also begun to address the management challenges imposed by the use of SaaS (e.g., Khajeh-Hosseini et al. 2010; Bento and Bento 2011). Given the eminent market expectations and the significance of SaaS for client organizations, I consider SaaS as a vital subject to study the impacts of IT-based innovation on IT governance. That is, since SaaS has passed the initial stadium adoption, it should be feasible to observe potential differences in the way IT artifacts are governed between SaaS using and non-using organizations. Furthermore, enterprise applications and their organizational embedding are often seen at the core of the IS discipline (Orlikowski and Iacono 2001; King and Lyytinen 2006). Thus, the selection of SaaS as an IT-based innovation is expected to provide relevant insights for a broad range of companies. Finally, I also consider this selection appropriate to allow for cross-sectoral considerations in comparison with the M-Government scenario.[5]

[5]Obviously, SaaS is not limited to the enterprise field (see Janssen and Joha 2011), and neither is the

1.3 Thesis Structure

The purpose of this chapter was to introduce the research presented in this thesis and to motivate why M-Government and SaaS are two examples of IT-based innovations that are particularly suitable for studying the mutual relationship between IT governance and innovation adoption. In the following, I provide an outline of the thesis structure. The overall flow of the chapters is summarized in Table 1.1.

Table 1.1: Thesis structure

Foundations of IT Governance and Organization Design	
• Dimensions of IT organization design (2.3) • Four IT organization archetypes (2.4) • Motivation for further research (2.5)	
Methodological Foundations	
• Epistemological framing (3.1) • Qualitative methods (3.2) • Quantitative methods (3.3)	
IT Governance and Innovation Adoption in E-Government	**Innovation Adoption and IT Governance in Enterprise IS**
• Innovations in Mobile Government (4.1) • Towards Transformational IT Governance (4.2) • Citizen Acceptance in Urban Sensing (4.3) • Municipal Benefits of Urban Sensing (4.4)	• The impact of SaaS on IS authority (5.1) • Comparing authority for on-premises and SaaS (5.2) • A process model for explaining governance of SaaS (5.3) • The dual role of IS specificity for governing SaaS (5.4)
Conclusion and Contributions	
• Theoretical contribution (6.1) • Practical contribution (6.2) • Methodological contribution (6.3) • Limitations and further research (6.4)	

In order to better explain the context of this thesis (i.e., IT organizations and their structural alignment within the wider organization), the following chapter (Chapter 2) provides an introduction to contemporary IT governance and organization design. The chapter reviews the broader Information Systems (IS) and Management literature and

mobile channel reserved for the government sector (see M-Commerce, Siau et al. 2001). However, I argue that these two innovations are currently just in the 'right' phase of diffusion to study the effects of (and effects on) IT governance in public (and private) sector.

proposes a conceptual framework consisting of six dimensions that are crucial in IT organization design. Since these dimensions are inherently correlated, we further integrate them in a 2×2 framework that puts the allocation of IT decisions and IT resources into the focus and explains the emergence of distinct organizational archetypes. The understanding of these archetypes is an important basis for this thesis, inasmuch as the following chapters will make reference to some of the underlying design dimensions. In addition, this chapter points out further research opportunities regarding the contingencies that determine the emergence of different organizational archetypes. It therefore also serves as a broader motivation for the research conducted in this dissertation.

In Chapter 3, I provide an overview of the different methodological foundations that are required to conduct the research presented in dissertation. These include the use of qualitative and quantitative empirical methods as well as design-oriented approaches. The chapter is headed by a preamble, which briefly discusses the embedding of this work in the philosophy of science and explains the epistemological view that is adopted in this dissertation. Since the individual research contributions only briefly explain the methodological backgrounds of each study (i.e., the reader's knowledge of the methodologies is generally presumed), this chapter can be understood as a reference for the methodologies used in this thesis.

The main part of this dissertation consists of two chapters, each containing four subchapters that report on the studies conducted. Chapter 4 deals with governance and IT-based innovations in E-Government, in particular Mobile Government (M-Government). In the first subchapter (4.1), I investigate the adoption of a broad spectrum of M-Government services among a sample of German municipalities. Based on the findings, in subchapter 4.2 I explore four cases of M-Government adoption in detail and analyze the role of IT governance in this context. To address some of the inhibitors prevailing in municipalities, I shed more light on the citizen side of M-Government adoption in subchapter 4.3. More precisely I focus on the adoption of *urban sensing*, which represents an emerging class of external M-Government services. Finally, subchapter 4.4 makes the proposition that more municipalities should consider M-Government services in their municipal E-Government strategies by describing a concrete case of urban sensing adoption and providing an in-depth investigation of the benefits achieved.

The second half of the main part (Chapter 5) is devoted to IT innovations and governance of enterprise information systems (IS), particularly for Software as a Service (SaaS). The first subchapter (5.1) explores the potential impact of SaaS on IS authority by analyzing four cases of SaaS adoption and proposes a contingency model to explain application-level governance phenomena. This model is then refined and evaluated in a large-sample survey where I also compare governance arrangements for SaaS and on-premises software (Chapter 5.2). Given the limitations imposed by such factor-based approach, I revisit some of the cases from Chapter 5.1 and demonstrate a process-theoretic approach to analyze application-level governance phenomena (5.3). Based on this procedural conceptualization of SaaS adoption, I am able to resolve some of the inconsistencies that emerged from the purely factor-based contingency perspective on SaaS adoption in Chapter 5.4. These findings unveil a dual influence of the specificity characteristics of SaaS application for allocating application governance and thus potentially also IT governance.

The final chapter (Chapter 6) summarizes the results of this research and discusses its contributions. In particular, I outline the contributions regarding the key theoretical constructs of this research, i.e. the mutual relationship of IT governance and innovation adoption (6.1). Furthermore, I discuss practical contributions reflecting the role of IT governance in public versus private sector organizations (6.2). Finally I outline methodological contributions that can be gathered from this work regarding the use of mixed methods in Information Systems research (6.3). The dissertation concludes by outlining the overall limitations and providing directions for further research (6.4).

In the remainder of this thesis, the subchapters will be simply referred to as *chapters*. Forming parts of a cumulative dissertation, these chapters represent self-contained research papers with separate introductions, theoretical foundations and conclusions. Therefore, they can also be read independently from each other according to the interests of the reader. At the time of publishing this thesis, the introductory chapter and the eight research papers have been published or are still in the process of publication. For clarification, each chapter will be introduced by a short preamble stating the authors and status of publication, as well as making specific acknowledgments, if applicable. Table 1.2 provides an overview of the published chapters of this thesis.[6]

Table 1.2: Overview of publications

Ch.	**Outlet**	**Reference**
2	Computer Science Handbook, Third Edition - Information Systems and Information Technology, Taylor & Francis	(Winkler and Brown 2013b)
4.1	Internationale Tagung Wirtschaftsinformatik (WI) 2011 Proceedings	(Winkler and Ernst 2011)
4.2	European Conference on Information Systems 2011 (ECIS) Proceedings	(Winkler et al. 2011b)
4.3	European Conference on Information Systems 2012 (ECIS) Proceedings	(Winkler et al. 2012a)
4.4	Journal of Theoretical and Applied Electronic Commerce Research (JTAER) Special Issue on Smart Applications for Smart Cities: New Approaches to Innovation	(Winkler et al. 2012b)
5.1	International Conference on Information Systems (ICIS) 2011 Proceedings	(Winkler et al. 2011a)
5.2	Working paper (under review)	(Winkler and Brown 2013a)
5.3	Multikonferenz der Wirtschaftsinformatik (MKWI) 2012 Proceedings	(Winkler and Günther 2012)
5.4	International Conference on Information Systems (ICIS) 2012 Proceedings	(Winkler and Benlian 2012)

[6]The author of this dissertation is also the first author of all of the constituting papers. Nevertheless, the narrative perspective will switch to plural ("we") to express the joint opinion of all authors.

2 Foundations of IT Governance and Organization Design

2.1 Preamble

This chapter presents a slightly shortened version of a book chapter by Winkler and Brown (2013b) to appear at Taylor and Francis in the third edition of the "Computing Handbook Set – Information Systems and Information Technology (Volume 2)," edited by Heikki Topi and Allen Tucker. I gratefully acknowledge the permission of my coauthor for including this work as an introductory chapter of this dissertation as well as the suggestions of the editors during the review process.

2.2 Introduction

How to organize and configure the internal Information Technology (IT) function[1] has been a critical issue since the beginning of enterprise computing. One of the most important challenges in IT organization design is selecting the extent to which IT decision-making and IT resources (including the IT workforce) are centralized (Brown and Magill 1994). The key rationale for centralization is to leverage economies of scale; the underlying rationale for decentralization is to ensure local responsiveness to internal and external customers, including innovative solutions (Sambamurthy and Zmud 1999; Agarwal and Sambamurthy 2002; Weill and Ross 2004a).

Over the past decades, IT organizations have oscillated between centralized and decentralized forms (Peak and Azadmanesh 1997; Evaristo et al. 2005). In the beginning of enterprise data processing, mainframe computers and magnetic tape devices were commonly organized in central data centers. After the late 1980s and the vast growth of distributed computing (Von Simson 1990), client-server and firm-wide enterprise resource planning applications led to IT re-centralizations (Brown 2003; McAdam and Galloway 2005). Many firms further consolidated large parts of their IT infrastructure and application operations into independent shared services organizations (Evaristo et al. 2005). These serve several lines of business to gain further economies of scale advantages as well as to improve the quality of overall IT service delivery through introducing standard IT practices (Schulz et al. 2009). While recent IT reference frameworks—such as ITIL,

[1]The terms information systems (IS) and information technology (IT) are both used in the literature to describe the IS/IT organization and IS/IT function. In this chapter we will use the term "IT" when referring to an organizational unit performing all or some of the IT functions within an enterprise.

ISO/IEC20000, CMMI and COBIT—provide some guidance for designing the IT function and internal processes (Pardo et al. 2011; Marrone and Kolbe 2011), this chapter takes an enterprise-level perspective.

In this chapter we present four IT organization archetypes that differ based on the centralization versus decentralization of both (1) IT decision rights and (2) allocated IT resources. We describe these archetypes based on four additional design dimensions: (3) coordination mechanisms, (4) financial autonomy, (5) sourcing arrangements, and (6) IT-related capabilities and skills. Being mindful that in the past the form of organizing the IT function has been heavily dependent on technological development, we predict that recent technology trends, such as cloud computing and the consumerization of IT, are likely to affect IT organization designs of the near future.

2.3 Six Dimensions of IT Organization Design

Organizations (for-profit as well as non-profit) typically consist of multiple units that may represent different functions or departments, lines of business, markets or geographies (Daft 2009). We use the term 'IT organization' to refer to the collectivity of human resources that perform IT-related tasks, such as planning, building and operating information technology applications and their underlying computer and communications infrastructures, as well as the relationships, practices, norms, and capabilities of these resources. This definition does not restrict the notion of an IT organization to the existence of a single organizational unit (i.e., "the IT department"). Rather, it offers the possibility to assume different design options for different IT units, depending on the needs and capabilities of the business unit(s) supported. We also propose that six important dimensions distinguish an IT organizational design, as described below.[2]

2.3.1 Allocation of IT Decision Rights

According to IT governance theory, decisions on information technology can be made in a more centralized or decentralized fashion (Brown and Grant 2005). In a corporate setting, centralization typically refers to allocating decision making at the corporate level, while decentralization refers to decision authority at the divisional level or even lower organizational levels (Brown and Magill 1994). A simple scheme includes two primary decision areas: IT applications and IT infrastructure operations. A widely adopted pattern in which infrastructure decisions are centralized, but business application decisions are primarily made by the divisions, has been commonly termed a federated or *federal* model (Sambamurthy and Zmud 1999). More recently, Weill and Ross (2004a, p. 6) proposed a five-part classification scheme that distinguishes decisions about business application needs, IT investment and prioritization, IT architecture, IT infrastructure strategies, as

[2] As the focus of this chapter is on explaining varying organization structures, we refrain from an in-depth discussion of IT processes. However, we will make reference to process-based IT reference frameworks and core IT processes where suitable.

well as overall IT principles, with different patterns associated with different business priorities. Defining accountability and the sharing of decision rights between the two extreme poles of centralization and decentralization is commonly seen as a key challenge. However, some studies have demonstrated that companies with well balanced IT decision rights exhibit better business-IT alignment and thus ultimately achieve superior firm performance (Weill and Ross 2004a, p. 202). An IT reference framework such as COBIT can be used to apply overarching accountability schemes to the design of decision rights on the activity and role level.

2.3.2 Allocation of IT Resources

The second dimension captures the structural aspect of the IT organization, i.e., the position and location of the IT human and technology resources within the wider enterprise. Although some prior literature has implied that IT decision rights and IT resources reside together in an organization—we argue that these two dimensions should be considered separately (cf. Boynton et al. 1992; Brown and Grant 2005). For example, IT decisions may be made in a decentralized manner by business units, while IT resources operate under either divisional or corporate IT authority. Similarly, IT staff may be allocated to a line organization, but these IT resources implement services under centralized authority.

IT resource allocations have also been categorized as either *IT demand* or *IT supply* resources (Thiadens 2005; Mark and Rau 2006). That is, divisional IT units may plan for and formulate the IT resource demand for IT services at a division or business unit level, although a central IT unit (or an external supplier) may have responsibility for actually 'supplying' the IT services to meet the specific business demand. Demand activities for IT operations, for example, include monitoring the delivery of IT services and issuing requests for minor changes to the infrastructure. Demand activities for IT application development include business process analysis, requirements definition, and user acceptance testing, as well as overall IT project management and steering. Although the focus of reference frameworks such as ITIL and COBIT is standardizable IT processes for IT supply units, they can provide some guidance also for designing demand-sided IT activities. For example, ITIL defines a dedicated demand management process as a responsibility of a demand manager (reporting to an IT unit).

In practice, the degree of centralization of IT resources differs widely under different IT organization archetypes (Brynjolfsson and Hitt 1998). In highly decentralized IT organizations, divisional IT units also accomplish IT supply tasks, while in very centralized IT organizations, corporate IT groups also manage much of the IT demand. The distribution of resources has overall been found to reflect the extent to which companies pursue economies of scale, versus enabling local responsiveness through the allocation of resources (Brown and Magill 1994).

The first two dimensions of our framework—*allocation of IT decision rights* and *allocation of IT resources*—form the axes for the 2×2 matrix in Figure 2.1. In addition to the Centralized and Decentralized polar extremes, two other IT organization archetypes are defined. In the Shared Services model, IT decision rights are highly decentralized, but the IT resources that perform IT tasks are highly centralized. In the Corporate Coordinator model, the IT resources are highly decentralized or outsourced, but a central office holds a higher degree of IT decision rights. Four additional design dimensions for characterizing these archetypes are described below.

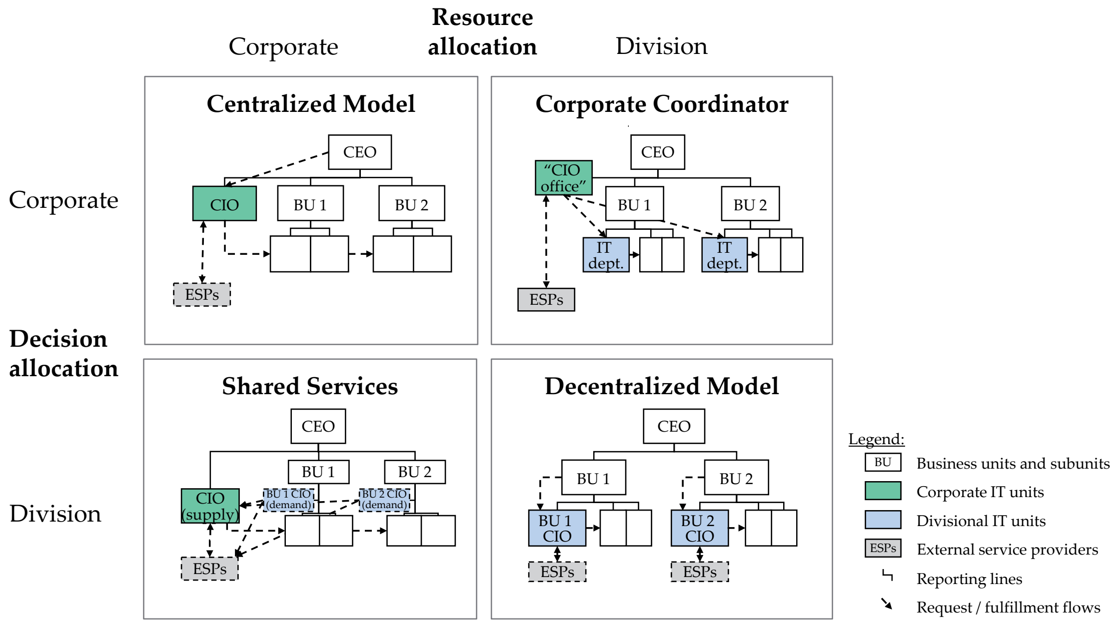


Figure 2.1: IT organization archetypes

2.3.3 Coordination Mechanisms

The mechanisms for coordinating IT tasks across multiple organizational units—e.g., corporate functions, business units or divisions, and/or corporate and divisional IT groups—are an important complementary design dimension to the formal allocation of decision rights and resources (Brown 1999). They can be viewed as an *overlay* of the structural organization, which enables horizontal, not just vertical, information sharing (Daft 2009, p. 95). In general, the more complex and dispersed allocations of decisions and resources are, the more sophisticated coordination mechanisms need to be to effectively coordinate and integrate across the different parties involved in decision making and execution (Peterson et al. 2000). Three categories of coordination mechanisms have been emphasized in the literature: structural mechanisms, procedural mechanisms, and relational mechanisms (Van Grembergen 2004, p. 20).

Structural mechanisms include 'standing' groups or committees (in contrast to temporary teams or task forces), and formal roles that link across different organizational units. Widely used standing groups for IT governance decisions are, for example, IT steering committees with key business representation and IT management councils (Brown 1999). Formal liaison roles for IT demand management have also been implemented in many organizations within both business and IT units, e.g., account managers and business analysts reporting to IT units, as well as divisional information officers, business process owners and key users residing in business units. Specific examples of tasks for such committees and liaison roles are now also part of common IT reference frameworks.

Procedural mechanisms are the specified rules and standard practices for decision-making and alignment between business and IT units (Peterson et al. 2000). Processes that span business and IT units include the IT strategy process, the IT budgeting and investment review process, project controlling processes, system change request and service level management procedures, etc. Naturally, both formal roles and standing groups are highly involved in effectuating procedural mechanisms. Common reference frameworks typically define a number of processes that involve these roles and groups—e.g., ITIL's demand management, service level management, change management and incident management processes.

Relational mechanisms characterize those practices that aim to link stakeholders in different organizational entities *informally* (i.e., outside of their role description or formal responsibility). Common approaches are communities of practice, key user networks, physical co-location, temporary job rotations or simply interdepartmental events. While IT reference frameworks largely neglect the less 'formalizable' relational mechanisms, academic researchers have emphasized the importance of informal mechanisms as a necessary complement to formal mechanisms (Brown 1999; Chan 2002). For example, relational mechanisms are apt to facilitate knowledge sharing and mutual understanding among different stakeholder groups (Peterson et al. 2000).

2.3.4 Financial Autonomy

The strategic management and accounting literature differentiates between different forms of financial autonomy for divisional units, such as cost, break-even, profit and investment center types (Anthony and Govindarajan 2007, p. 247). Applied to (corporate and divisional) IT units, the type of center not only has important implications for internal chargeback arrangements between business and IT, but also determines the degree of financial and managerial autonomy of an IT unit (Venkatraman 1997). Reference frameworks such as ITIL and COBIT generally acknowledge the importance of this organizational design dimension, but provide minimal design guidance.

In a *cost center* type, the IT unit is led by budget goals and is thus exclusively accounting for the costs of delivering internal IT services. Chargeback mechanisms are typically not in place (thus creating a possible incentive for business managers to underfund their units).

The *break-even center* defines service-based chargebacks based on the actual costs for delivering IT services. Thus, being a mixture between cost and profit centers, the goal of this center type is to close break-even. Since IT costs (e.g., for personnel, hardware, software) are often not directly accrued to an IT service, more complex cost and activity accounting schemes need to be established than in a cost center type. Such cost models often approximate the actually incurred IT cost, combining direct and indirect costs (Ryan and Raducha-Grace 2009).

Profit centers have greater financial autonomy inasmuch as their management carries responsibility for costs and (internal or external) revenues for IT services. Costs are charged to the customers on a more competitive basis, often oriented towards market-based transfer prices. However, in practice, business units are often obligated to contract with an internal IT profit center, so the degree of market competitiveness with external IT service providers is limited.

Investment centers extend profit center responsibilities to include accountability for the investment of accrued capital, so that this type of IT unit can be viewed as an independent 'company within the company'. In large corporations, both profit and investment centers are commonly constituted in separate legal entities, subsidiary to the parent company.

2.3.5 Sourcing Arrangements

IT decision makers continuously face the question about which tasks can be better and more efficiently performed by an external party. The IS literature provides a large body of knowledge with relevant considerations related to IT outsourcing (see Lacity et al. 2009 for an overview). Outsourcing arrangements can be differentiated regarding the coordination mode with an external provider—e.g., selected contractual obligations ('arms-length' relationships) for cost efficiency, versus long-term relational partnerships ('embedded') for strengthening IT resources and technological flexibility (Lee et al. 2004). Notably, in recent years, the focus has shifted from long-term, comprehensive IT outsourcing arrangements and purely economic considerations to contracts that also target quality, flexibility and innovation goals (e.g., Whitley and Willcocks 2011). Recent literature also emphasizes the need for in-house capabilities for governing the different kinds of outsourcing relationships effectively (e.g., Willcocks and Griffiths 2010). One model of nine IS capabilities for modern IT organizations, for example, includes four capabilities that are directly related to managing outsourcing providers: informed buying, contract facilitation, monitoring, and vendor development (Feeny and Willcocks 1998).

While both ITIL and COBIT describe some processes and activities related to managing third-party services, from an enterprise design standpoint, the crucial concern is the *locus of outsourcing governance*, i.e., whether sourcing capabilities are allocated at the business level, the central, or the divisional IT side (Agarwal and Sambamurthy 2002). IT outsourcing decisions can also result in a change in decision rights for that particular IT function, including decentralizing more such rights to business units (Brown 2003). For example, in situations where resources for IT demand already reside in business units or divisional IT groups, this organizational configuration increases the outsourcing readiness of these units and thus the likelihood that an outsourcing relationship will be governed directly by the division. This may as well create more pressure on central IT units to compete with external providers—especially when business units are not obliged to contract internally. Financially autonomous IT supply units that are organized as subsidiary to their parent corporations (i.e., captive IT centers), can therefore also be viewed as transitional structural arrangements prior to outsourcing IT supply to an external party (Kreutter and Stadtmann 2009). In such situations, building appropriate demand-side IT capabilities may become a strategic priority (Feeny and Willcocks 1998).

2.3.6 Capabilities and Skills

We define a capability as *the application of knowledge, competencies and skills residing in human resources, to accomplish given organizational goals* (Peppard and Ward 2004). Our second dimension, allocation of IT resources, refers to the structural assignment of human resources within the organization, whereas this dimension focuses on the aggregate proficiencies that IT human resources within an enterprise need to have. The IS literature has proposed different categories of capabilities in IT organizations. In addition to the nine-capability framework of Feeny and Willcocks (1998), a common typology derived from marketing research distinguishes between inside-out, outside-in, and spanning capabilities (Wade and Hulland 2004).[3]

Inside-out refers to capabilities that are internally focused, such as IT infrastructure, IT development and (more generally) cost effective IT operations—here referred to earlier as *IT supply* capabilities. Outside-in and spanning capabilities are externally oriented, placing an emphasis on requirements and customer relationships, including IT planning and change management, IT/business partnerships, market responsiveness, and external relationship management. These capabilities are likely to be aligned closely with business units and here we characterize them as *IT demand capabilities*.

Some more fine grained competency and skill categories can be found in both the academic and practitioner literature, including a framework of 36 skills in five categories (Zwieg et al. 2006), skills related to roles in ITIL and CMM capabilities, as well as in frameworks such as the Skills Framework for the Information Age promoted by industry groups within the U.K. (SFIA 2012).[4] With the increasing pressure of IT organizations to compete on the product and labor markets, the development of appropriate IT demand and IT supply competencies becomes a more important imperative. A wide range of IT human resource practices, such as recruitment, training and retention, and proactive career development can guide IT organizations to achieve this goal (Luftman 2011).

Table 2.1 summarizes the seminal literature that has motivated our inclusion of each

[3] Although Wade and Hulland (2004) refer to these as categories for resources, their definition of resources as "assets and capabilities that are available and useful in detecting and responding to market opportunities or threats" is congruent with the notion of capabilities used in this chapter.

[4] The SFIA Foundation is a not-for-profit organization that exists to own, promote, develop and maintain the Skills Framework for the Information Age. The members of The Foundation are UK Industry bodies in the field of IT: BCS (The British Computer Society), e-skills UK (e-skills UK Sector Skills Council Ltd.), The IET (The Institution of Engineering and Technology), IMIS (The Institute for the Management of Information Systems), and itSMF (IT Service Management Forum).

of the six design dimensions.

Table 2.1: Organizational design dimensions

Dimension	**Key design questions**	**Selected literature**
1) Allocation of decision rights	Which decision rights are allocated to business units, corporate, and IT stakeholders?	Brown and Magill 1994; Sambamurthy and Zmud 1999; Weill and Ross 2004a; Brown and Grant 2005
2) Allocation of IT resources	Which degree of centralization is appropriate? Where is the split between IT demand and supply resources?	Boynton et al. 1992; Brynjolfsson and Hitt 1998; Mark and Rau 2006; Thiadens 2005; Daft 2009
3) Coordination mechanisms	Which integration mechanisms (structural, procedural, relational) are implemented?	Brown 1999; Peterson et al. 2000; Chan 2002; Van Grembergen 2004
4) Financial autonomy	Which degree of autonomy is appropriate for IT units? Which center type is implemented (cost, break-even, profit, investment center)?	Venkatraman 1997; Anthony and Govindarajan 2007; Ryan and Raducha-Grace 2009
5) Sourcing arrangements	Which degree of external sourcing is appropriate? Which services are sourced externally? Which organizational units govern sourcing relationships?	Agarwal and Sambamurthy 2002; Lee et al. 2004; Lacity et al. 2009; Willcocks and Griffiths 2010; Whitley and Willcocks 2011
6) Capabilities and skills	Which capabilities are needed for IT demand and IT supply? How are these developed within the organization?	Feeny and Willcocks 1998; Peppard and Ward 2004; Wade and Hulland 2004; Zwieg et al. 2006; Luftman 2011

2.4 IT Organization Archetypes

In Figure 2.1 we presented the four basic archetypes of IT organization configurations that are based on the first two dimensions described above: the distribution of IT decision rights and IT resources. In the following, we describe these archetypes in more detail, including their characteristics on the other four dimensions, their occurrence in practice, their strengths, as well as some common challenges.

2.4.1 Centralized Model

In a centralized model, most IT decision rights are allocated to the corporate level and IT resources are reporting to a central IT unit subordinate to corporate control while serving multiple business units. An IT steering or advisory committee has been recognized as an important coordination mechanism for ensuring business leader input into IT decision-making (Brown 2003; Huang et al. 2009). Under this model, the IT function is typically operated as a cost- or break-even center with simple chargeback arrangements. For example, in a corporate setting, a combination of global and business unit-related IT budgets may be managed together with project-level and person-day based internal pricing. External contractors are typically governed by the corporate IT unit. Therefore, central IT resources not only need to be equipped with IT supply capabilities, but also with sufficient IT demand capabilities to identify business needs and translate these into successful delivery by internal resources and external partners (as applicable).

Centralized models were the primary type of IT organization during the early era of mainframe computing and into the late 1980s when relational databases had arisen, however, networking was still limited (Peak and Azadmanesh 1997). A second wave of centralization also occurred the mid-1990s as large firms initially implemented complex enterprise system packages (Brown 2003; McAdam and Galloway 2005). Today, centralized IT functions are also still the predominant model for small and medium sized businesses (Huang et al. 2009). Strengths of this model relate to an inherently high degree of standardization and corresponding efficiency through the sharing of IT resources and an underlying IT architecture across all divisions. Common challenges are business responsiveness and often a (perceived) lack of business contribution, that is, the IT organization may appear to act as a 'black box' from a divisional perspective. Many centralized models have experienced improvements in IT responsiveness by enhancing both formal and informal coordination mechanisms, e.g. by introducing dedicated liaison roles and cross-functional IT meetings (Brown 1999; Huang et al. 2009).

2.4.2 Decentralized Model

In a decentralized model, business units make IT decisions (divisional or lower level) and are also responsible for managing IT resources. In the pure decentralized model, a central IT unit does not exist, which means that today it can be viewed as an almost 'anarchic' configuration, with no or little coordination on a corporate level (Weill and Ross 2004a, p. 58). In small divisions, coordination can even be achieved via informal, relational mechanisms, costs may not be accrued as a separate IT budget and chargeback arrangements may not be implemented. If decentralized models make use of external suppliers/contractors, potentially for selected IT sourcing or project resources, these are typically governed outside of corporate control.

The decentralized model became more common after the expansion of mini-computers in the late 1970s, when most of the information processing took place in closed (proprietary) systems managed by local IT experts (Peak and Azadmanesh 1997). The rapid growth of desktop computing and more modern distributed computing architectures also facilitated more decentralization (Von Simson 1990). The disadvantages of this model as a 'pure' model lie in the cultivation of silo structures and a lack of IT cost transparency. Similar downsides relate to the commonly undesirable phenomenon of "shadow IT," i.e., the existence of ad-hoc IT solutions built, used, and managed by the business without central involvement or approval (Raden 2005). However, decentralized configurations can still be appropriate in cases where a strategic independence of a certain business division is desired, which may even include divestment-readiness (Leimeister et al. 2012). This model can also be appropriate for business functions where high innovation through IT and autonomous IT use are a strategic imperative, for example in the research and development departments in a technology-intensive industry.

2.4.3 Shared Services Model

In the Shared Services model depicted in Figure 2.1, the IT resources are highly centralized, while the IT decision rights are primarily located at the division level. That is, divisions share the usage of centralized resources to capture advantages associated with a Centralized model—including economies of scale and scope and joint IT architecture planning—without giving up major decision rights to a corporate IT unit. The business divisions typically also participate in steering committees and other decision-making bodies—such as cross-divisional IT boards responsible for IT architecture, IT application prioritizations, and infrastructure management—to set priorities for all of the divisions using the centralized IT resources. Shared services units are financially more autonomous than a purely centralized model and are responsible for their own results (Schulz et al. 2009). IT organizations that transition to this model therefore often need to devote significant efforts to productize their IT services on a competitive cost basis, so that they can retrieve their costs with chargebacks to their business customers (Ryan and Raducha-Grace 2009). External service providers may also be contracted for, and governed by, the shared services unit, especially for infrastructure services. However, depending on their size and maturity—and policies of the overall organization—business divisions may also have sufficient IT demand capabilities (and authorization) to independently contract out to external parties and thus circumvent the shared services unit.

Some of the early roots for this model can be seen in the writings by Von Simson (1990) and others in the 1990s, when organizations sought to better balance the advantages of a centralized model with those of a decentralized model with hybrid approaches. One hybrid approach was to create a federal model with IT application rights *and* resources residing within the divisions or business units, but IT operations (rights and resources) in a corporate IT unit. In contrast, in a ‘pure’ Shared Services model, IT decision rights are at the division level, but IT (both application and infrastructure operations) resources are centralized. The global implementation of enterprise systems beginning in the late 1990s, which required both centralized application maintenance and process-based customizations, has been one of the catalysts for a wider acceptance of the pure shared services model (Brown 2003).

In many corporations today, shared services have therefore become a dominant model to organize and deliver IT as well as other enterprise support functions (e.g., accounting, physical facilities management), which are therefore sometimes co-located with IT (Schulz et al. 2009). Companies thereby aim to combine the benefits of centralization (economies of scale and scope) for IT applications and operations, with the benefits of outsourcing (e.g., customer focus, quality orientation, and increased variable versus fixed costs at the division level)—without sharing the potential drawbacks of outsourcing to an external supplier (e.g., supplier sustainability, loss of internal know-how, regulatory compliance and data security concerns, etc.).

Sometimes this model is also seen as an opportunity to generate additional business, or as a strategic step before entirely outsourcing IT operations. Until the mid 2000s, many major corporations set up such IT subsidiaries with the primary goal of generating external revenues during a time of tremendous IT expansion in developed countries—a strategic trend that from today's perspective, with few exceptions, can be counted as a failure (Kreutter and Stadtmann 2009). Reasons for why many of these 'captive' players could not sustainably hold ground in an external market include the changing capability requirements for internally versus externally competing service providers, and the rise of mature IT outsourcing firms that utilize cheaper labor.

Some of the inherent challenges of this model also relate to the lengthier channels of communication from business demand to IT supply units (delivery), which may need to be coordinated across multiple division (and country) boundaries. For this reason, sophisticated governance mechanisms, including service level agreements by business units, as well as strong demand-side IT capabilities, are required in order to implement this model successfully (Peterson et al. 2000; Van Grembergen 2004).

2.4.4 Corporate Coordinator Model

In the Corporate Coordinator model, IT-related tasks are performed externally or by divisional resources (i.e., by divisional IT units or non-IT business users themselves), while a central IT authority (office of the CIO, or in some cases a CTO[5]) governs through IT decision rights and aligns the IT resource investments with an overall IT architecture strategy. In the 'pure' form, the office of the CIO is empowered to develop and enforce standards and monitor adherence via the CIO's direct report to corporate management, but does not possess dedicated resources to provide IT supply. Corporate IT standards differ in extent and range, from the usage of certain technology platform and application standards, to guidelines for risk management and security controls. The reliance on committees and other coordination mechanisms to balance corporate and cross-functional priorities is similar to the Shared Services model. However, in a Corporate Coordinator model, these governance bodies are under the CIO, who has greater decision making rights. For example, large IT development projects and sourcing arrangements to be managed at the division level may require pre-approval from the CIO.

External providers are contracted centrally by the office of the CIO or by divisional IT groups, depending if the service being sourced has firm-wide impacts (e.g., infrastructures and communication) or only divisional impacts (e.g., consultants and IT specialists in a project context). The CIO office acts as the mediator of external IT services, which are charged back to the divisions based on the costs of provision. Financial autonomy

[5] The Chief Technology Officer (CTO) role has evolved from research and development (R&D) management positions in technology-based industries and has recently also attracted more attention as a point of strategic responsibility for long-term goals and guidelines for the use of information technology within organizations (Hunter 2011).

of the internal, divisional IT units is generally low, costs are accrued to divisional IT cost centers that are consolidated in divisional budgets, and no chargebacks take place at the division level. However, global cost transparency is warranted through oversight by the CIO and a global portfolio of divisional and corporate IT projects. For IT supplier steering and internal as well as external coordination, the central CIO office needs to develop strong demand capabilities (e.g., IT planning and change management, market responsiveness, and external relationship management). IT supply typically takes place through external suppliers or through divisional IT resources (as applicable).

The Corporate Coordinator model in its pure form is appropriate for several particular contexts, of which we highlight three. First, establishing a CIO office is often used strategically as a first step to advance from very decentralized configurations to more centralized governance and transparency, before actually centralizing resources, consolidating infrastructures and achieving global scale. Second, for some business models which are based on replication (i.e., different entities with low data integration needs but similar business processes), a Coordinator model is the appropriate choice, due to its ability to leverage standardization potentials and economies of scale in IT sourcing, without integrating IT architectures (Ross et al. 2006, p. 35). Examples for such business models are diversified conglomerates as well as franchise companies.

Finally, the CIO office as a mediator of external IT services enables the ongoing IT outsourcing and industrialization trend. That is, the more (diverse) services are procured from the external market, the higher is the need for expert buyers to steer and manage these providers in order to achieve the desired benefits (e.g., costs, flexibility and innovation goals). Thus, establishing a Corporate Coordinator model can be a viable alternative to building the distributed and costly demand capabilities in the business divisions—as required for the Shared Services model.

The key challenge of the Corporate Coordinator model is its difficulty in effectively implementing centralized IT governance to leverage economies of scale and standardization via negotiations across division heads. This may explain why this archetype—as a model for the entire IT organization—is still uncommon today in practice.

The four IT organization archetypes and their key characteristics are summarized in Table 2.2.

2.5 Motivation for Further Research

Past research has proposed traditional business drivers such as a firm's competitive strategy and structure as influencing the 'choice' of the archetype of an IT organization (Agarwal and Sambamurthy 2002; Brown and Grant 2005). For example, more globalized firms seeking responsiveness to local markets are likely to decentralize some IT rights and responsibilities, while smaller firms striving for economies of scale are likely to centralize their IT decision rights and resources (Sambamurthy and Zmud 1999; Weill and Ross 2004a; Huang et al. 2009). However, more recent literature also emphasizes the complementarity between organizational and technological architecture (Tiwana and

Table 2.2: Key characteristics of four IT organization archetypes

	Centralized	**Decentralized**	**Shared Services**	**Corporate Coordinator**
IT decision allocation	CIO with senior management support	Business unit leaders (separately)	Business unit leaders (federally) and central CIO	Central CIO office enforcing standards, local implementation
IT resource allocation	IT resources in corporate IT	IT resources in local divisions	IT resources in shared IT unit, few IT demand resources	IT resources in divisions or external, few strategic IT resources in CIO office
Coordination mechanisms (structural)	Business relationship managers, IT steering committee	Divisional IT heads, divisional management boards	Divisional IT managers, central account managers, cross-divisional IT boards, e.g. IT architecture board	Executive board, divisional IT heads, architecture board
Financial autonomy	Cost or break-even center, simple chargebacks	Cost center or accrued to other budgets, no chargebacks (for small divisions)	Break-even,profit or investment center, productized chargebacks	Chargebacks for external IT services, cost centers for divisional IT, global monitoring
Sourcing arrange-ements[a]	ESPs governed by corporate IT	ESPs governed by divisional IT	ESPs governed by corporate IT or divisional IT	Firm-wide ESP contracts governed by CIO office, specialist ESPs by divisional IT
Capabilities and skills	Good demand capabilities in corporate IT needed	Demand from business, supply capabilities in division IT	Ideal split of IT demand and IT supply capabilities realized	Demand capabilities in CIO office, supply capabilities in division IT (or externally)
Strengths	Standardization, resource pooling, efficiency	High responsiveness and local innovation, strategic independence	Economies of scale and responsiveness, customer-orientation, IT cost transparency	Expert sourcing by CIO office, standardization, global IT cost transparency, strategic independence
Common challenges	Lack of business value contribution, low flexibility	Lack of efficiency, low cost transparency, silo structures	More complex governance, longer communication channels, IT supply competes externally, conflicting sourcing governance	Difficult to empower CIO office, lack of strategic IT competence in business divisions

[a]ESP = External service provider

Konsynski 2010).

We conjecture that recent technology trends such as cloud computing and IT consumerization are likely to affect the IT organization models for both the IT demand and supply sides. More specifically, cloud computing and the Internet-based delivery of applications and components as a service will further push the border of what is 'core' and what is 'commodity' across enterprise application landscapes (Bento and Bento 2011). Thus, on the application level, business units are more likely to manage their own cloud applications in a more decentralized fashion and thus circumvent centralized investment procedures (Winkler et al. 2011a). At the back-end, fewer IT resources will be needed for the operating infrastructure. However, managing the technological architecture and integrating cloud-based services with internal and external infrastructures will pose increasingly important challenges and the need for new capabilities.

Consumerization of IT superimposes the cloud wave. Employees with increasing IT skills and access to sophisticated client devices for personal use expect to find IT tools in their workplace that they already use in their home environments (Bernnat et al. 2010). As an answer to these new expectations, some companies have created policies for allowing employees to bring their own devices, such as smartphones and tablet PCs, into the work environment and integrate them. This represents a paradigm shift inasmuch as employees are subsidized for using their own hardware and applications. Data security and other related risks need to be diligently addressed by enforcing appropriate firm-wide guidelines.

These and other technology trends suggest greater decentralization of IT responsibilities and more hybrid IT governance designs in the future. More application as well as infrastructure decision rights (e.g., on mobile device use) will shift to tech savvy business users, while IT operations responsibilities are increasingly shared between internal and external suppliers. Managing the diverging ecosystem of user IT demand and entire supply chains of IT service provision will be one of the key IT governance challenges in the future (McDonald 2007). Enterprise-level organizational models that enable a better integration and coordination across users, IT units and multiple suppliers will need to be developed, which we expect to be reflected in future versions of standard IT reference models (Pardo et al. 2011; Marrone and Kolbe 2011).[6]

Beyond the technology contingencies, other perspectives also appear particularly fruitful for investigating the changing shape of contemporary IT organizational configurations. First, industry-specific approaches have largely been neglected in the past. Organizations in the public sector, for example, national and local governments as well as non-profits in healthcare and other industries, hold different principles for creating public versus private value, which may also call for different principles of IT governance (Weill and Ross 2004a, pp. 185-214, Sethibe et al. 2007). Second, given the increasing dispersion of IT value creation across organizational ecosystems, the understanding of 'organizational

[6]For example, in its 2011 version ITIL has introduced additional strategic processes and liaison roles to address increasing coordination needs, such as a service strategy manager, a business relationship manager, and a demand manager.

configurations' needs to be broadened to span entire IT value networks (Leimeister et al. 2010; Iyer and Henderson 2012). This also implies that the extensive, yet separate literature strands on governance of (internal) IT functions and governance of (external) outsourcing relationships need to be united under a common frame. Third, such governance arrangements may significantly vary depending on the kind of IT subfunctions considered. Various authors have begun to investigate IT organization and governance phenomena regarding certain subdomains, such as governance in system development projects (Tiwana 2009), application governance (Winkler et al. 2011a), data governance (Khatri and Brown 2010), and infrastructure sourcing governance (Xue et al. 2011). Taking such modular views and aligning these with overall (networked) governance schemes appears a promising field for future researchers. Finally, having argued that organizational configuration is a dynamic phenomenon influenced by business and technology developments, we conclude that more longitudinal research is needed to study IT organization design phenomena.

2.6 Summary

Organizing and designing the information technology (IT) function is a critical management issue, and one that is influenced by business factors and technology trends. In this chapter we focused on the organizational embedding of the IT function in the wider enterprise. We presented a 2×2 matrix of archetypes for the IT function (Centralized, Decentralized, Shared Services, and Corporate Coordinator models) that differ based on the centralization versus decentralization of IT decision rights and allocated IT resources. Then we described these archetypes based on four other design dimensions: coordination mechanisms, financial autonomy, sourcing arrangements, and IT-related capabilities and skills. Finally, we argued that current technology trends, including Cloud computing and IT consumerization, increase the need for corporate IT coordination and thus are likely to lead to more hybrid models in practice. We presented different perspectives that appear particularly fruitul to explore contemporary IT governance phenomena.

3 Methodological Foundations

In this chapter I explain the methodological foundations for the research conducted in this thesis. The methods applied in this research acknowledge the existence of different epistemological paradigms. They can be broadly classified by qualitative and quantitative empirical methods, depending on the nature of data that is used for analysis (i.e., word versus number data).

3.1 Epistemological Preamble

The question of what is knowledge and how we acquire knowledge—epistemology—has has been a focal point of philosophy for more than a century since the period of Immanuel Kant (Störig 2011, pp. 757-762). In his "Kritik der reinen Vernunft", Kant arbitrated between the two conflicting and emerging positions of his time. These were the strict *empiricism*, which demanded the creation of new knowledge (inductively) only from what is directly observable, and the *rationalism*, which proclaimed reason and (deductive) thinking to be the primary source of new knowledge. Parallel to disruptions in mathematics and physics (for example, the proposition of a non-euclidean geometry), later philosophers (the Vienna circle) arrived at a neopositivist (or logical positivist) view, stating that science should describe and intend to explain what is 'positively given', i.e.—in the tradition of empiricism—the perceptual observations by the senses and impressions. However, in case certain 'laws' emerge from these research activities, these are thought of as models and results of our own thinking, rather than laws of nature that determine our reality. The controversy, of to what extent certain 'laws' can actually be verified, was a vital contribution added by Karl Popper, who introduced the principle of falsification. This principle can be regarded as the basis of modern science in that it states that hypotheses about a population of subjects can never be veryfied, but only falsified. This implies that what we consider as knowledge always remains with a hypothetical and somewhat provisional character, as Popper himself acknowledged (Störig 2011, p. 778).

However, the propositions by Popper have also been subject to criticism in several directions, particularly regarding the mapping between theoretical laws and observations, as well as the role of language. Even physicists like Albert Einstein noted that the notions and terms we use to denominate real-world phenomena are all creations of our own thinking and cannot be derived inductively from perceptual observations, and therefore the worlds of the observable and of the theoretical are inherently separated (von Kutschera 1972, p. 489). This criticism can also be related to the emergence of constructivism, a philosophical direction originating from different scientific domains that emphasizes—in simple words—that what we perceive as our 'reality' may be ultimately the result of our own construction. In general, positions that take a stance against a positivist view are summarized as antipositivist (or also interpretivist) views. Originating from sociology, interpretivism focuses on understanding the meanings that social actions have for the individuals being studied, rather than aiming to derive generalizable laws (Macionis and Gerber 2011, p. 32). Given that we first need to understand and describe the phenomena we observe before we can derive lawful relationships, interpretive research today is widely regarded as a complement to (neo-)positivst positions (Bryman 2004). Early advocates of such paradigmatic pluralism are frequently seen in Paul Feyerabend and Thomas Kuhn. However, Kuhn also emphasized a revolutionary view of scientific progress where, after periods of 'normal science', a paradigm can disruptively shift to another (Hoyningen-Huene 2002). In this sense, the emergence of different research paradigms can also be viewed pragmatically, i.e. by asking which paradigm is more suited to explain the phenomenon of interest.

In the Information Systems (IS) field, interpretive studies have become more common after the seminal work of Orlikowski (1993). Although there is often a tendency to equate a positivist paradigm with quantitative methods and an interpretive paradigm with qualitative methods, this equation obviously appears somewhat "crude" (Mingers 2003, p. 236). This is because the paradigmatic view taken by a researcher is assumed to be independent from the nature of the data used. To make two simple counter-examples, the positivist case study (Yin 2003) is typically based on qualitative data, conversely grounded theory—a classic interpretive approach (Glaser and Strauss 1967)—explicitly encourages to include both qualitative and quantitative data in the analysis. Besides these dimensions, further dichotomies can be used to characterize a research approach, particularly intensive vs. extensive, data-driven vs. theory-driven (e.g., Mingers 2003), exploratory vs. confirmatory (e.g., Boudreau et al. 2001), process-theoretic vs. variance-theoretic (e.g., Newman and Robey 1992), and behavioral vs. design-oriented (e.g., March and Smith 1995; Hevner et al. 2004). Gregor (2006) provides a taxonomy of five classes of theory that can emerge from using different epistemological paradigms and summarizes the prevailing approaches in the IS field. This taxonomy also provides an argument for how different types of theory can be linked. For an in-depth discussion of these issues I may refer to the given literature.

The majority of the studies in this thesis assume a neopositivist perspective. That is, both qualitative and quantitative approaches aim to provide evidence and find lawful relationships between constructs, which potentially first need to be identified and described. In this sense, the qualitative (intensive) approaches seek to study in depth a small number of cases, while the quantitative (extensive) studies aim to make empirical generalizations based on an a large number of cases. However, in the sense of neopositivism, we acknowledge that all relationships and models provided by this research only represent *one* potential way of interpreting real-world phenomena (and not natural science like 'laws'). Given this epistemological premise, we will not make explicit reference to the adopted research paradigm for each study, unless the study deviates from this paradigm (which may be the case for Chapters 4.4 and 5.3). In particular, Chapter 4.4 takes an action design-oriented perspective that is more based on a paradigm of intervention than observation (Sein et al. 2011). Chapter 5.3 takes a process-theoretic perspective that can be viewed closer to interpretivism (Newman and Robey 1992).

3.2 Qualitative Methods

In the scope of this thesis, we may distinguish four types of qualitative research approaches: interviews, content analysis, grounded theory, and case studies. Note that these four types are (by far) not exhaustive; for a broader overview see (Myers 1997).

3.2.1 Interviews

Interviews are certainly the most common method in qualitative research for data acquisition and typically used in combination with further analysis techniques. Interviews should be well prepared by the researcher and guided by a script that may take an unstructured, semi-structured, or structured (i.e., survey interview) form (Warren 2002, pp. 83-101). Accordingly, the researcher may consider the use of open-ended versus close-ended questions.

In the IS field, interviews can be conducted, for example, with users of an information system or 'experts' regarding a certain phenomenon. The selection of subjects obviously implies an important influence for the further direction and the results of a study (Warren 2002, pp. 87). Semi-structured interviews are the most common form in IS (Myers and Newman 2007). However, despite the significance of this data acquisition method, Myers and Newman (2007) find that the use of interviewing is often not sufficiently reported in IS studies and the potential challenges are often overlooked. Common pitfalls relate to missing positioning of the interviewer and interviewee (e.g., clarifying the roles of the interviewer and interviewee, establishing a trust relationship, explaining reasons for the interview), the communication between interviewer and interviewee (e.g., language and interpretations, biases resulting from the interviewers perception, variety of voices) as well as to the content of the interview itself (missing flexibility in the script, omitting potentially interesting topics, missing sensitivity to the context) (Myers and Newman 2007). Interviews are typically recorded (which may as well impose some biases) and transcribed for further analysis.

3.2.2 Content Analysis

Content analysis refers to a bundle of techniques that aim to synthesize aggregated insights from amount of qualitative data, e.g. transcribed interviews, organizational documents, news feeds, as well as pictures or videos. These techniques have in common that they try to reduce the complexity of information contained in the underlying data by relating fragments from it to an (either predefined or emerging) set of categories (represented as codes). This process termed *coding* typically delivers a (hierarchical) system of categories (i.e. main categories, categories, subcategories, etc.). Coding is commonly seen as the first step before the codes (more precisely, the pieces of content that are assigned to a code, i.e. for text material the quotations) undergo further analyzes. These may be frequency analyzes (i.e., counting the number of occurrences of specific codes), valence analyzes (i.e., assigning an emotional tone to the each occurrence, e.g. either positively or negatively), or intensity analyzes (i.e., measuring the degree of an occurrence on an appropriate scale). Reliability of human coding procedures is of paramount importance, given that the goals is to produce relatively objective (or at least inter-subjectively comprehensible) results. (Neuendorf 2002, p. 141). Therefore it is recommended that two or more coders perform coding and that coefficients of intercoder reliability are reported (Neuendorf 2002, p. 148).

The content analysis methodology also explicitly encourages researchers to conduct further statistical analyzes on these evaluated set of codes. In this sense it can be practically regarded as a *quantitative* analysis method based on *qualitative* data. For example, joint occurrences of codes from different main categories, or occurrences for different subjects (e.g. interviewees) are relationships that a researcher might want to test. Recently also a number of methods from machine learning are used to aid researches in conducting coding and analysis procedures for large sets of unstructured qualitative data, specifically latent semantic analysis and data mining methods (e.g., Indulska et al. 2012). However, content analysis is often charged with not being ‘sufficiently qualitative’ in that counting codes and applying statistical inference obscures the richness provided by qualitative data and its interpretation (Morgan and Others 1993).

3.2.3 Grounded Theory

Grounded theory (GT) was developed by Glaser and Strauss (1967) in the 1960s, a period where logico-deductive thinking gained dominance and qualitative research was often considered unscientific (Charmaz 2003, p. 251). With their book *The Discovery of Grounded Theory*, Glaser and Strauss intended to provide a new methodological framework that especially addressed young students (“the kids”) who were still free from preconceptions (Legewie and Schervier-Legewie 1995). This framework provided a procedure to generate substantive theory that is systematically derived from, or grounded in, data, rather than being a new ‘theory’ itself (therefore the name GT can be regarded as somewhat misleading, as Strauss admits in a later interview with Legewie and Schervier-Legewie 1995).

GT foresees a rather prescriptive set of guidelines for both data acquisition and analysis. First, acquisition and analysis are not thought of in a sequential, but rather in a simultaneous manner where the researcher constantly compares new to old data and generates new concepts from it, until a state of ‘theoretical saturation’ is reached. During this process—comparable to content analysis—the data is coded in three logical iterations: open coding, axial coding and selective coding (whereas axial coding has been added later by Strauss and Corbin 1998). In simple words, data fragments are assigned

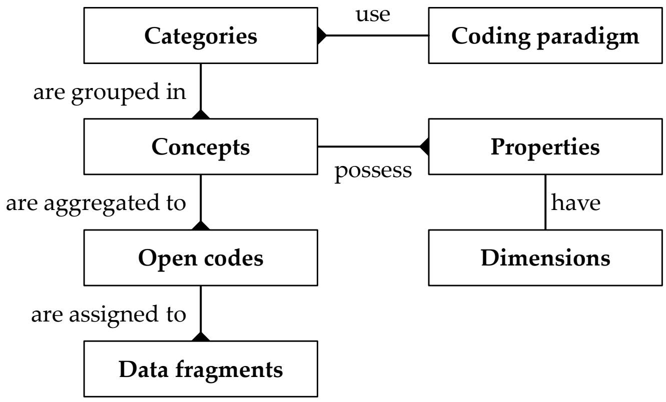


Figure 3.1: Grounded theory elements (author's representation, simplified entity relationship notation)

to codes which are then aggregated to concepts in open coding. In this activity, the method demands 'theoretical sensitivity' to the phenomena observed, particularly by constantly comparing observations with other (theoretical) occurrences. Axial coding relates concepts to each other by making use of a basic set of categories. Glaser refers to this as 'coding families', which can be used flexibly to address the specific type of phenomenon of interest (Glaser 1978, pp. 73-82). Straussian GT is more prescriptive by recommending a 'coding paradigm' that comprises causal conditions, context, intervening conditions, action/interaction, and consequences (Strauss and Corbin 1998, pp. 96-97). Selective coding is done after a 'core category' has been identified. Then, all relevant concepts can be grouped around this core category (related by the coding paradigm or coding family), while others can be eliminated. The GT coding procedure and how the different elements are related is depicted in Figure 3.1.

Originating from the field of nursery studies (see Glaser and Strauss 1967), GT has soon expanded into many other domains, such as sociology, education and psychology (Charmaz 2003, p. 252). In the IS field, GT has become more common after the entering into a leading journal with Orlikowski (1993). Although GT describes a holistic approach for conducting research (i.e., including a sampling strategy as well as an interpretive epistemological attitude), the most common application of GT in IS field is analytical, i.e. as a method for analyzing qualitative data (Matavire and Brown 2008). In this regard, it has also been combined with other qualitative methods, especially with case study approaches (e.g., Hughes and Jones 2003; Fernández 2005; Strong and Volkoff 2010).

3.2.4 Case Studies

In the social sciences, a case study generally refers to the intensive study of a single unit of analysis (e.g., an organization, a project, or an individual) or—as well—to the comparative analysis of multiple units, i.e. a multiple case study. These methods generally regard the 'cases' as instances which are particularly revelatory to study a broader class of problems within a wider population. The selection of cases, therefore, should be based on the richness of information provided by each case, rather than (only) statistical sampling (Merriam 1998). Flyvbjerg (2006, p. 229) notes that "atypical or extreme cases often reveal more information because they activate more actors and more basic mechanisms in the situation studied." For the selection of multiple cases, Yin (2003) emphasizes that a replication logic is needed to determine whether the cases are intended to strengthen or broaden the insights from each other. He speaks of a *literal replication* logic when cases are selected to corroborate each other, while a *theoretical replication* dictates to select cases that are expected to exhibit different conditions or outcomes. In practice, it is acknowledged that the case selection and data acquisition also often have to follow opportunistic criteria since researchers do not always have access to those cases which are potentially the most revelatory (Patton and Others 1990, pp. 182-183).

Case study research includes techniques for both data acquisition and analysis. It recommends to 'triangulate' between data from multiple sources, particularly interviews, documentation, archives, direct observation, participant observation or artifacts (Yin 2003, p. 85)—in this respect it is similar to GT, where 'everything is data'. In contrast to grounded theory, data analysis methods for conducting case study research are not very prescriptive. The main requirement is rather that the outcomes exhibit "a clear chain of [logical] evidence" as Benbasat et al. (1987, p. 374) suggests. For a multiple case analysis, Eisenhardt (1989b) recommends to first perform within-case analysis and then search for cross-case patterns. Different tactics can be applied, such as selecting categories or dimensions and then looking for within-group similarities and intergroup differences. Other tactics are to compare cases pairwise or to divide the data by sources (e.g. interviews vs. documentation) (Eisenhardt 1989b).

In the IS field, case studies are a common and versatile research method that can follow different epistemological paradigms. A meta-review by Mingers (2003) counts that more than one fourth of the publications in major IS journals use some form of a case study, which follow either positivist, interpretive or intervention paradigms. In a positivist sense, case studies can be regarded as the ideal type of test for falsification, i.e. "if just one observation does not fit with the proposition, it is considered not valid generally and must therefore be either revised or rejected" (Flyvbjerg 2006, p. 228). From an interpretive stance, case studies are thought of to provide *generalizations to* theory, rather than verifying or testing theory. Walsham (1995) outlines that interpretive case studies can particularly contribute generalizations of concepts, networked concepts, propositions, as well as implications for a particular domain of action. Finally, intervening case studies, such as action research approaches, aim to change a real-world problem and derive a generalizable solution from this, rather than focusing on pure observation (e.g., Maartensson and Lee 2004; Sein et al. 2011).

Table 3.1: Overview of research methods

	Qualitative methods				Quantitative methods			
	Interviews[b]	Content analysis[c]	Grounded theory[(b)c]	Case study[(b)c]	Survey[b]	Structural equation modeling[c]	Clustering / subgroup analysis[c]	Simulation[bc]
Chapter 4.1	x	x			x	x	x	
Chapter 4.2	x	x	x	x				
Chapter 4.3					x	x		
Chapter 4.4	x			x				x
Chapter 5.1	x		x	x				
Chapter 5.2					x	x	x	
Chapter 5.3[a]	(x)			x				
Chapter 5.4[a]					(x)	x	x	

[a]Data based on a previous study (x)
[b]Data generation method
[c]Data analysis method

3.3 Quantitative Methods

Table 3.1 presents and overview of the research methods used in this thesis. The quantitative methods can be distinguished in survey, structural equation modeling, clustering and subgroup analysis, as well as simulation approaches.

3.3.1 Survey

Surveys are certainly the most widely used method for acquiring quantitative primary data in the social sciences. They can be regarded as means of mass communication between a researcher and number of subjects (and vice versa, of course) (Churchill and Iacobucci 2002, p. 270). Surveys typically use a questionnaire that may capture structured or unstructured data. More interesting for statistical analysis are obviously structured (i.e. closed-ended) questions with fixed alternatives due to the possibilities for statistical evaluation. Depending on the phenomenon studied and the planned method of analysis, the researcher should draw attention on the types of (structured) questions used. These can include binary, categorical, multiple-choice, scaled, numeric, or ranking type of questions.

Most common for operationalizing psychometric models are Likert scales (Likert 1932), i.e. questions where the subjects are asked to evaluate their attitude to a statement on a bipolar and (presumably) equidistant scale (often with 5 or 7 points). Churchill (1979) proposed a rigorous eight-step procedure to develop scales for measuring latent variable constructs. This approach focuses strongly on the interrelatedness of construct items and has therefore been criticized by later authors (foremost Rossiter 2002)—in simple words—for optimizing reliability at the costs of content validity. Rossiter even advocates the use of single-item constructs whenever it is justified by the nature (e.g., a low level of abstraction) of the construct. However, increasing the number of items per construct—while causing greater survey length and potential redundancy of questions—statistically increases the predictive validity of a model (Diamantopoulos et al. 2012). A second important question related to this discussion refers to the use of formative versus reflective indicators to measure latent variable constructs (see also next Section 3.3.2).

The total questionnaire should have a clear structure and follow a logical thread (e.g., from the most general to the most specific) in order to sustain the subjects' attentiveness (Churchill and Iacobucci 2002, p. 345). Before being administered, surveys should be validated thoroughly and pretested with the potential subjects to increase understandability and minimize later measurement errors (Hunt et al. 1982). Surveys can be administered, for example, via mail, online, telephone or in person. Researchers typically need to balance criteria of sampling control (i.e., who answers), information control (i.e., the quality of information and potential biases), and administrative control (i.e., time and money) in choosing an appropriate administration method (Churchill and Iacobucci 2002, p. 296). Potential biases in the survey method may result from the sample frame (e.g., non-representativeness, undercoverage), the responses (e.g., nonresponse, voluntariness, social desirability, cognitive consistency) and the measurement (e.g., leading questions, insensitive measures, ambiguity) (Podsakoff and Organ 1986; Hartman et al. 2002). Such biases should be taken into consideration, both a priori in the study design and a posteriori by testing for them.

3.3.2 Structural Equation Modeling

Structural Equation Modeling (SEM) refers to a class of multivariate analysis techniques that combine the use of latent variables (LVs) with path analytic modeling—for this reason they are also sometimes referred to as *second generation* multivariate analysis techniques (e.g., Fornell and Larcker 1987). Coupling two traditions—a psychometric emphasis of measuring latent (unobservable) variables by multiple indicators and an econometric perspective of prediction through a directed graph of relationships—SEM enjoys high popularity across many disciplines, also due to the increase in software packages to perform such analyzes (Chin 1998a). This prevalence can also be explained in that a path model reflects our thinking in chains of causal relationships and thus facilitates translating such theories into data analysis.[1] Mathematically, this analysis method uses a (usually)[2] linear equation system with indicators (i.e., observable) variables connected via LVs and coefficients, which are then estimated by the algorithm, subject to according error terms.

[1]Misleadingly, structural equation models have sometimes also been named as 'causal models', although SEM does only ascertain statistical association, not causality.

[2]More recently, also non-linear approaches to PLS have been proposed, e.g. for modeling U- and S-shaped relationshipships (see Kock 2010)

There are two different approaches to SEM, the covariance-based (CB) and variance-based SEM (Jöreskog and Wold 1982). CB-SEM aims to estimate the model parameters (i.e., coefficients) by fitting the covariance matrix from the structural equations to the empirical covariance matrix observed in the sample (Reinartz et al. 2009). Therefore, it is also considered as a "hard modeling" approach where normal and interval-scaled distribution assumptions and several hundreds of cases are necessary (Tenenhaus et al. 2005). In contrast, the variance-based partial least squares (PLS) SEM estimates parameters by maximizing the variance explained for all LVs by iterating through a series of ordinary least squares regressions (Reinartz et al. 2009). This "soft modeling" approach is thought to pose less distribution assumptions and generally works with smaller sample sizes than CB-SEM (Tenenhaus et al. 2005). Besides the fundamentally different goals of both approaches—i.e., confirming a model structure versus exploring and predicting variable relationships—the suitability of both approaches has been widely discussed (e.g., Marcoulides and Saunders 2006; Reinartz et al. 2009; Marcoulides 2009; Hair et al. 2011). This thesis makes use of PLS-SEM and briefly states in each study the motivations that led to this choice.

SEM allows for some specifics in modeling and measuring theoretical relationships. First, LVs in SEM (both CB-SEM and PLS-SEM) can be measured by reflective or formative indicators, depending on the assumed direction of the effect. Reflective indicators assume that the questionnaire item reflects the 'true' value of the LV plus an error term. Formative indicators, in contrast, compose the LV by a linear combination of their values and certain weights, i.e. the error accrues in the LV value (Cenfetelli and Bassellier 2009). SEM also allows for the conceptualization and use of second-order (or even higher-order) models where a first-order construct is reflected in, or composed by several second-order constructs (Wetzels et al. 2009; MacKenzie et al. 2011). Furthermore, researchers become increasingly interested in the study of interaction effects such as mediation and moderation in SEM (Chin 1998b). In brief, a mediation effect occurs when the inclusion of a variable M (the mediator) *in between* a variable A and B leads to a weaker direct effect from A to C. A moderation effect occurs when a variable M (the moderator) influences the *strength* of a linkage between A and B. For PLS-SEM, interaction effects can be modeled and tested in different ways (Hayes 2009; Henseler and Chin 2010).

When estimating a SEM model, a number of quality criteria should be assessed, whose extensive discussion would go beyond the scope of this introduction. For PLS-SEM, the measurement model (i.e., all observed variables and their relationships to the LVs) and the structural model (i.e., the endogenous relationships between LVs) are commonly assessed separately (Chin 1998b). Quality criteria for reflectively measured LVs relate to convergent validity (i.e., whether the indicators measure the same construct) and discriminant validity (i.e., whether distinct LVs and their indicators differ sufficiently). Opposed to this, formative indicators are included in the model 'by definition' due to their constituting meaning for a construct, so that—similar to an ordinary regression—only multicollinearity should be ruled out (Cenfetelli and Bassellier 2009). The structural model is assessed based on the parameter estimates for the path coefficients. Unlike to CB-SEM, PLS-SEM does not directly provide p-values for statistical significance.

Therefore t-values are generated by a bootstrapping (or jackknifing) procedure that repeatedly draws pseudo samples from the base sample and thus obtains a distribution of the parameter estimates (Hair et al. 2011). Note that in terms of a 'falsification' (Popper), for two-sided tests the null hypothesis is that *there is no linear relationship* (i.e., path coefficient=0), so that conversely a non-significant path does *not* inform whether the real world is *free* from such relationship.

3.3.3 Clustering and Subgroup Analysis

In this category I summarize a few further group analysis methods that are used in this thesis in combination with SEM. These methods aid in both the discovery of previously unknown groups by clustering, as well as the analysis of categorical (i.e., previously known) subgroups of the sample. Clustering techniques detect groups of objects in a larger sample based on their similarity characteristics (assessed by appropriate distance measures, Johnson and Wichern 2007, pp. 673-678). Hierarchical clustering (also called linkage or connectivity-based clustering) methods either start from the individual objects *or* the group of all observations and succeed by aggregating (or partitioning) objects (groups) by iteratively merging (de-merging) the two objects (subgroups) that are closest to (farthest from) each other (Johnson and Wichern 2007, pp. 680-696). Wards linkage (the type of clustering method applied in this thesis), is a special hierarchical clustering method that considers the 'loss of information' from joining two groups, usually measured by an *increase* in the error sum of squared deviations from the cluster mean (centroid) (Johnson and Wichern 2007, p. 692). Wards linkage typically produces clusters that can be elliptically shaped and have more equal cluster sizes compared to other hierarchical methods (Backhaus et al. 2003, p. 516). This makes this clustering method somewhat superior for studying multivariate observational data in the social sciences (Punj and Stewart 1983).

A second method used in this thesis refers to multidimensional scaling (MDS) (Chapter 5.4). MDS is similar to clustering in that it assesses objects based on their similarities; however, in MDS these classes of objects are determined a priori by the sample. MDS allows for displaying multivariate data by transforming it to a low-dimensional (i.e., typically two- or three-dimensional) space and thus visualizing similarity characteristics (Kruskal and Wish 1978; Kappelhoff 2001). MDS uses an iterative algorithm. Based on a start solution (x, y), objects are compared pairwise by their compound similarity relative to their spacial distance. If two dissimilar objects lie relatively close to each other, they are moved apart (conversely if two similar objects lie relatively far from each other, they are moved closer). This procedure is repeated until the configuration of objects sufficiently reflects the similarity characteristics. The criterion for evaluating the goodness of a configuration is called STRESS and is usually measured by the explained variance from a regression of object dimensions on the position vector (x, y). The stop criterion can be the number of maximum iterations or a minimum increase of STRESS from one iteration to another (Kruskal and Wish 1978, p. 25). Altogether, both clustering and multidimensional scaling (as well as other analysis techniques) allow to explore subgroup characteristics and potential heterogeneity in multivariate a data—such as latent variable factor scores from a PLS-SEM model.

Another criterion for multigroup comparison in SEM is the dissimilarity of path coefficients (Johnson and Wichern 2007, p. 678). This approach is different from clustering or MDS as it focuses on the strengths of effects on a dependent variable in each subsample, rather than the characteristics of the sample (or latent variable scores) itself. Testing for path differences can be accomplished by a special t-test statistic using the standard errors from separate bootstrapping procedures, as demonstrated in (Keil et al. 2000, p. 315). More recently, an alternative test has been proposed that relies on the observed distribution of the bootstrap values instead of the standard errors (Henseler et al. 2009). Both of these tests are applied in Chapter 5.3. Finally for completeness—analogue to clustering techniques for the factor values—more sophisticated segmentation techniques, most prominently finite mixture models, also allow to form subgroups based on (presumably) heterogeneous path coefficients in the sample (Jedidi et al. 1997).

3.3.4 Simulation

Simulation as a research method generally refers to studying the behavior of a system or a process over time, usually by the use of computational means. Similar to statistical models such as in SEM, simulation approaches use some kind of model with defined input (i.e., 'exogenous'), auxiliary (i.e., 'endogeneous') and output (i.e., 'dependent') variables. However, simulations *produce* data rather than analyzing or testing it. The relationships between these variables can take any mathematical complexity, e.g. represented by non-linear, conditional, stochastic, and differential equations. Differential equations are especially important since they make simulation models 'time-aware', i.e. a variable may depend on the (differential) change, or the accumulated sum (integral) of past values of this or another variable over time. Therefore simulation models can also exhibit loops, which poses a complexity that usually makes it impossible to find a closed-form analytical mathematical representation.

Simulation approaches can target at both a better understanding of a system behavior and/or the prediction or certain variables of interest. As it is in the nature of 'modeling', usually a number of assumptions need to be made regarding input variables and the proposed variable relationships. Proponents of the simulation method particularly put forward that the process of modeling and running a simulation model itself increases the understanding of potentially complex systems (e.g., Stave 2002). Additional analyzes can be conducted based on a simulation model, for example scenario analyzes (i.e., comparing simulations with different underlying assumptions), sensitivity analyzes (i.e., quantifying changes in an output variable to changes in an input variable), or monte-carlo simulation (i.e., assuming probabilistically distributed input variables and studying the distribution of output variables). Individual-based simulations (also multi-agent systems, which are not in scope of this thesis) model the behavior of autonomous agents in order to assess the effects on a system, rather than directly describing the system as a whole (Bousquet and Le Page 2004).

In the IS field, simulations are one of the less frequently used ‘outlier’ methods (Mingers 2003, pp. 243, 245). Notably, other fields that are as well characterized by multi-disciplinary and social, technical and organizational views—for example health care research—make distinctively larger use of simulation either as a primary or as a secondary (i.e. supporting) research method (Brailsford et al. 2009). One of the reasons for this ‘paucity’ in the IS field may be that reviewers have less confidence in the (approximate) validity of simulation models, and researchers respectively do not sufficiently validate their simulation models (Forrester and Senge 1978). Nevertheless, proponents argue that researchers can use simulation approaches to go beyond the role of the individual and study the different interactions among agents in different organizational levels (Bousquet and Le Page 2004).

4 IT Governance and Innovation Adoption in E-Government

4.1 Innovations in Mobile Government

4.1.1 Preamble

This chapter has been initially published and presented at the German Tagung Wirtschaftsinformatik (WI) January 2011 in Zurich, Switzerland (see Winkler and Ernst 2011). Some of the formulations and statements may deviate from the original paper due to the translation from German to English.

4.1.2 Introduction

The ongoing technological development of mobile broadband networks also results in a positive momentum for mobile Government (M-Government). It is expected that the number of people in Germany who regularly use Internet functions on the mobile phone will triple to more than 30 million from 2010 to 2012 (Computerwoche 2009; Bitkom 2010). While in the past M-Government was largely confined to simple services such as SMS[1] notifications and isolated intra-governmental applications (Trimi and Sheng 2008), new scenarios are emerging for the interaction between government and citizens, such as location-based reporting services, mobile library services, and intelligent car-routing systems.

Within the framework this study, the terminology and scope of M-Government will be understood broadly in relation to different actors and forms of mobility. Implementing M-Government services and applications can lead to significant changes in administrative processes. This issue receives additional relevance through current initiatives that are driven by national level and have both organizational and technological impacts on local M-Government implementations. Recent examples for such initiatives in Germany include the introduction of the single service number 115, the implementation of the EU Services Directive, and the introduction of the German electronic identity card.

Simultaneously to fulfilling such strategic requirements, many municipalities face massive cost pressures. For example, in North Rhine-Westphalia nearly two-thirds of municipalities need to manage their budgets according to a budget-balancing concept since they are significantly underfunded (NRW 2009). This limits the scope of action for

[1]Short Message Service

implementing innovative IT projects and leads to a more stringent review of economic efficiency. Accordingly, the core question of this study is whether M-Government can be regarded as a further stage of E-Government and thus a path to greater municipal efficiency—or whether it remains to be a marginal issue for those municipalities that still have some room for maneuver for implementing innovative IT projects?

While business related research often studies innovation adoption from the perspective of the enterprise (IT) decision maker, the E-Government literature has mainly viewed the citizen in the center of the adoption decision. Thus, applications that are used by government employees and achieve an intra-governmental benefit have often been neglected. Our study represents a novel approach insofar as we put the municipal IT decision maker—as an important stakeholder and source of stimulus—into the center of attention to explain municipal innovation adoption. Consequently, M-Government is understood as a bundle of potential services and applications and we consider a variety of possible application scenarios, rather than a single (citizen-centric) technology. This article makes a relevant contribution by pointing out (1) the organizational factors and conditions that affect a municipality in the implementation of mobile services, (2) how much these factors affect the perceived potential of mobile government services, and (3) what effect this has on the municipality's investment behavior.

The remainder of this chapter is structured in six sections. After a theoretical foundation and hypotheses development in Section 4.1.3, we present the results of a qualitative pre-study in Section 4.1.4. Building on this, we explain the methodology for the empirical study in Section 4.1.5 and analyze the results in Section 4.1.6. The last Section (4.1.7) summarizes this work, discusses practical implications and provides an outlook for future research.

4.1.3 Theoretical Foundations and Hypotheses Development

In the following we explain the terminological and theoretical foundations for our research on M-Government and develop the research model, see Figure 4.1.

Forms of Mobile Government

Following the definition of Kushchu and Kuscu (2003), M-Government can be understood as a *strategy and its implementation involving the utilization of all kinds of wireless and mobile technology, services, applications and devices for improving benefits to the parties involved in E-Government.* These parties do not only include citizens, but also involve businesses and employees in public institutions, as well as the governments as such. According to the common terminology that has been established for E-Government, we can also distinguish M-Government according to (mobile) government-to-Customer (G2C), government-to-business (G2B) and government-to-government (G2G) patterns, whereas the latter has also been termed as IEE (internal effectiveness and efficiency, Trimi and Sheng 2008). M-Government can thus be understood as an extension and subset of E-Government.

Technologies used in mobile government go far beyond the capabilities of telecommunications. Wireless networking, Bluetooth, CCTV (closed circuit television), location-based services, RFID (radio frequency identification), biometric identification, traffic monitoring, smart cards and NFC (near field communication) applications are just some examples of mobile (i.e., non-stationary) technologies, which are not necessarily used in conjunction with a mobile phone (Kumar and Sinha 2007). In a study by Winkler et al. (2009) we presented eight application clusters for M-Government services in an urban context, which can be arranged on a continuum between the public value and private economic benefits. This framework covers the sectors of public administration, public safety, education, health, transport, environment and infrastructure, tourism and culture, as well as applications for private households. This classification will also be used in course of this study as a framework to operationalize the concept of M-Government.

Behavioral and Theoretical Foundations

The literature on E-Government adoption and usage primarily draws on conceptual models that are based on innovation diffusion theory by Rogers (1962), Fishbein and Ajzen's (1975) theory of reasoned action, and Davis' (1989) technology acceptance model. Since the latter focuses on specific characteristics (particularly perceived usefulness and ease of use) of a concrete technological innovation, rather than a bundle of applications, we presume that it is less suitable for a holistic investigation of M-Government adoption. Therefore, we limit our theoretical perspective to the former two approaches.

According to Rogers (1962), an innovation is defined as *the acceptance of an idea or a practice over time by organizations or individuals that are connected in the form of communication channels, social structures and a system of culture and values.* The process of innovation goes through five phases of knowledge, persuasion, decision, implementation and confirmation. In this study we assume that developments in the field of M-Government are at present—in contrast to E-Government—predominantly still in the first three phases. Therefore, the study conceptually targets at the act of persuasion and decision for (or against) certain M-Government services.

The process of decision can be explained in more detail with the aid of the theory of reasoned action (TRA, Fishbein and Ajzen 1975). According to TRA, the behavioral intention of using a particular innovation is a mediator between the (objective) attitudes regarding this innovation and the behavioral outcome (i.e., adoption or non-adoption). The TRA was originally developed to explain the behavior of individuals, while in the complex structure of a local government there are presumably a number of actors involved in a decision for or against technological innovations. Nevertheless, we still consider the TRA to be applicable to a bundle of attitudes and behavioral intentions, provided that these can be adequately measured. In doing so, we follow several examples in the IS literature on organizational adoption, e.g. (Benlian et al. 2009). However, on an organizational level we assume that the influence exerted by *subjective norms* loses relevance for the opinion of a group of individuals (Fishbein and Ajzen 1975).

With regards to the provision of mobile services, we interpret the *attitude* of the

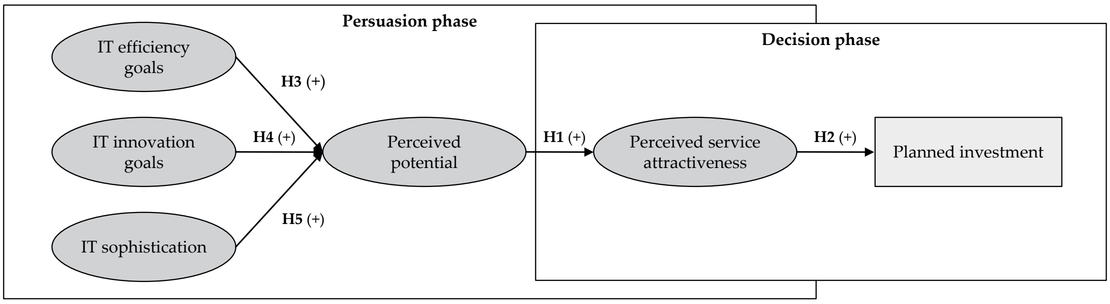


Figure 4.1: Research model

municipal decision-makers as an aggregate measure of the *perceived potential benefits* of M-Government. These may be influenced by the municipalities' strategic goals and the organizational context. The *behavioral intention* of adopting (i.e., using internally and/or offering mobile services to citizens) shall be operationalized as an aggregate measure of the *perceived attractiveness* of specific M-Government offerings. The intended behavior of a municipality to introduce a mobile service should then ultimately be reflected in the *planned investment* in M-Government services. Altogether, we postulate the following hypotheses:

H1: *There is a positive relationship between the* perceived potential *of M-Government in general and the* perceived attractiveness *of specific service offerings.*

H2: *There is a positive relationship between the* perceived attractiveness *of specific service offerings and the* planned investment *in M-Government services.*

Antecedents of Perceived M-Government Potential

Mobile Government has only more recently become subject of academic research so that we acknowledge a general lack of empirical works in this field (Kushchu 2007, p. 1). For this reason, we make reference to the related E-Government literature as well as to studies in the field of strategic IS and IT investment decisions to identify appropriate preconditions and factors influencing perceived M-Government potential.

There are a number of empirical studies in the E-Government field that examine the offering and the acceptance of innovative services, foremost government websites (see Patel and Jacobson 2008 for an overview). The large majority of these studies put the citizen as an end-user in the center of the adoption decision. Consequently, studies focus on individual antecedent factors such as trust in E-Government, IT experience of computer users and IT skills. Also, demographic characteristics such as gender and educational level are often considered as key factors. The work by Moon and Norris (2005) represents an exception inasmuch as they study organizational factors such as the size of the municipality and type of government (i.e., council-city manager versus mayor-council governments) to explain different levels of maturity in introducing E-Government across a sample of U.S. municipalities.

Further organizational antecedent factors may be derived from the the IS and IT alignment literature. The IT functions of municipal government are comparable to those in private sector firms, as both have to meet certain targets depending on the strategic goals and operational (business) requirements. Thus, we assume that there are also certain strategic guidelines and conditions for the introduction of M-Government services, depending on the situation in each particular municipality. Typologies of such IT strategies in the literature have often employed (parsimonious, yet not too simplistic) tripartite models (Denford and Chan 2007). For example, (Sabherwal and Chan 2001) mirror the well-known Miles and Snow typology of business strategies (defenders, analyzers, prospectors) to characterize an IT/IS strategy by the three attributes *IS for efficiency*, *IS for flexibility* and *IS for comprehensiveness*. Later authors get to similar partitions (Denford and Chan 2007). We combine the idea of having a triad of strategic IT attributes with the specific characteristics of E- and M- government adoption and postulate three dimensions related to *efficiency goals*, *innovation goals* and *IT sophistication* as important antecedents of M-Government acceptance.

Efficiency goals relate to the municipality's motif to support administrative processes through the use of mobile applications and thus ultimately save time and money. Depending on the budgetary situation of the considered municipality, we expect a variation in the in level of this dimension. The degree to which a municipality pursues *efficiency goals* primarily reflects the economic perspective in M-Government acceptance.

Innovation goals express the degree to which a community aims to extend its service offering in terms of effectiveness (yet not necessarily efficiency). Cities do not only compete with each other, but are also exposed to different expectations of their customers (see Kushchu 2007). We argue that in this dimension individual drivers of acceptance, such as the increasing technological affinity of citizens and employees and their evolving IT skills, also play an important a role (Patel and Jacobson 2008). New service offerings supported by mobile technology can help satisfy the continuous customer demand for innovation. Thus, this dimension addresses in particular the external perspective.

IT sophistication captures the IT-related prerequisites that are present in a municipality. This dimensions refers to both the physical and the "soft" infrastructure, as Kushchu (2007) notes. Thus, equally important to existing systems and networks are therefore institutional arrangements and a technological vision for M-Government. This claim is consistent with the findings of Tornatzky and Klein (1982) who state that compatibility with existing structures is crucial for a variety of types of innovation. We expect that municipalities that already make substantial efforts for E-Government implementations also have significant synergies when adopting M-Government services (Kushchu 2007). This dimension thus represents in particular the technological and organizational perspectives.

Altogether, these considerations lead us to the following three hypotheses, which are summarized in the research model shown in Figure 4.1.

H3: *There is a positive relationship between the* efficiency goals *of a municipality and* *the* perceived potential *of M-Government services.*

H4: *There is a positive relationship between the* innovation goals *of a municipality and the* perceived potential *of M-Government services.*

H5: *There is a positive relationship between the* IT sophistication *of a municipality and the* perceived potential *of M-Government services.*

4.1.4 Qualitative Pre-Study

To assure content validaty of our research hypotheses and operationalize the proposed constructs we conducted a series of interviews and performed a content analysis.

Participants and Method

This pre-study analysis was oriented in the method proposed by Neuendorf (2002) and conducted in two phases. We first established a categorical system according to the variables and dimensions in our research mdoel (Figure 4.1). In the first phase (test phase), three interviews were conducted with E-Government experts from the municipal administration of a large German city as well as a technology foundation that collaborates with public and private institutions. For the purpose of triangulation, it seemed appropriate at this stage to select interview representatives from both the departmental (i.e., demand) and IT (i.e., supply) sides in the same municipal context. Table 4.1 provides details about the job positions of the interviewees. We used an interview guideline based on the categorical system which included questions regarding the hypothesized aspects of each category as well as open-ended questions. The interviews were conducted as presence meetings interviews of approximately 60 minutes and recorded digitally. The analysis of interview transcripts was performed using the software Atlas.ti for qualitative analysis. Following an inductive approach, the category system was revised and further sub-categories were developed.

Table 4.1: Interviewees and city sizes

Phase	**Position**	**City size**
1) Test phase	Head of IT Competence Center	$>$ 200.000
	Head of Department of Media, Information and Communication Industries	$>$ 200.000
	Head of Information and Communication Technology (ICT)	$>$ 200.000
2) Coding phase	Head of Staff Function E-Government	180.000
	Head of Department (for Personnel, Organization, IT, and Education)	70.000
	IT Organizer	60.000
	Head of Data Processing	60.000

In the second phase (coding phase) we conducted interviews with IT executives from four other German municipalities. These phone interviews were conducted on the basis of the revised category system with a slightly adapted guideline (time approximately 45 minutes). Similar to the first phase, the coding of interview transcripts was performed independently by two coders and discussed in the case of disagreements. After revising the total 488 codes, we counted an agreement of 71 percent, which represents a good intercoder reliability (Neuendorf 2002, p. 141).

Operationalization of Antecedents

The subcategories resulting from the content analysis and number of codes are presented in Table 4.2. Since for the further analysis we only considered the three most frequently mentioned codes, our description will be limited to the these subcategories. Further subcategories referred to, for example, the availability of partners, intercommunal networks and synergies with other municipalities.

According to the interview results, the dimension of efficiency goals can be disaggregated into indicators that we termed *process improvement*, *win-win situation* and *efficiency improvement*. *Process improvement* refers to the motivation to use mobile services to improve certain processes in urban administration. *Win-win situation* emphasizes the aspect that this should not only achieve a benefit for the municipality, but also simultaneously for its customers (i.e., citizens and local businesses). *Efficiency improvement* particularly encapsulates such motivations that explicitly result from the need to save on costs.

Innovation goals are at first reflected in the *external demand* for providing novel services, referring to the pressure explicitly exerted by the municipality's customers. Secondly, it comprises one indicator that we label *service enhancements* summing up the motivations to offer new mobile services from out of the administration in order to expand the current serivce portfolio and present itself as a modern and innovative municipality. Finally, we also attribute the increasing *mobile consumerization* to this dimension, describing the development to which mobile devices and according service services become part of peoples (i.e., citizens and employees) everyday lifes, which also poses new opportunities and challenges to be addressed by municipalities.

As the first dimension of *IT sophistication*, *E-Government platform* captures the degree to which certain administrative processes are already supported (or enabled) by IT so that the municipality's services are accessible online. Building on a sound E-Government platform, we expect, will also facilitate the implementation of novel mobile services, since existing interfaces and technologies can be reused. In this context, interviewees also pointed to the importance of the existence of a comprehensive *service strategy* and an *IT strategy* with E-Government and M-Government elements, as these would facilitate the alignment of multiple stakeholders and enable a long term planning of the municipality.

Table 4.2: Operationalization of antecedent factors

Dimension	**Subcategory**	**Question** (How do you rate the motivating influence of the following factors to realize m-government services in your city?)
Efficiency goals (EF)	1. Process improvement	the need of the administration to improve the work processes
	2. Win-win situation	achieving a win-win situation for the municipality and potential users
	3. Efficiency improvement	the pressure to save money by increasing administrative efficiency
Innovation goals (IN)	1. External demand	the expectations from citizens and business to improve the administration
	2. Service enhancements	the development of new municipal service offerings enabled by mobile technologies
	3. Mobile consumerization	the increasing technological affinity in the population
IT sophistication (IT)	1. E-government platform	administrative processes that new mobile services are based on, are already implemented electronically
	2. Service strategy	your municipality has a comprehensive plan for future service offerings, which considers the use of modern information and communication technology channels
	3. IT strategy	your municipality has a comprehensive IT strategy that contains E-Government and M-Government elements

4.1.5 Empirical Study

Questionnaire Design

To test the proposed model, a comprehensive questionnaire was developed and validated. At the beginning of the questionnaire, we asked for context information regarding the to the city (inhabitants and municipal budget), and demographic information of the participant (age, job position, etc). All the following items were operationalized as 7-point Likert scales. The antecendent factors *efficiency goals*, *innovation goals*, and *IT sophistication* are understood as formative constructs that result from the sub-category indicators described above (4.1.4). Based on the qualitative pre-study, each of these indicators was operationalized on a scale from “1=no influence” to “7=very high influence”, see Table 4.2.

The main part of the questionnaire was a list of 60 possible mobile service offerings, each with a brief description that needed to be rated according to their perceived attractiveness for the municipality on a scale from “1=not attractive” to “7=very attractive”. These partly very innovative application scenarios were extracted from the academic and practitioner literature and grouped according to the application clusters introduced earlier (Section 4.1.3). Table 4.3 (page 51) shows a selection of these services.

The total perceived M-Government potential was also assessed based on the application clusters presented Section 4.1.3 and operationalized, i.e. by 8 items on a scale from “1=no potential benefit” to “7=very high potential benefits” for the municipality. We opted for replicating this structure to ensure that the respondents' understanding of M-Government was congruent with the groups of concrete rated mobile services, and thus supported content validity of both constructs. The planned investment in M-Government services was assessed directly by asking for the "estimated total investment of the municipality in mobile services within the next three years" as a single 7-point item with the interval limits <50; 100; 250; 500; 1,000; 5,000 and >5,000 thousand Euros.

The content validity of the questionnaire was checked carefully. The questionnaire items were first revised by several colleagues and experts in measurement theory and statistics. Following the method proposed by Hunt et al. (1982), the initial version of the questionnaire was then pretested in meetings with some of the interview partners involved in the pre-study, which lead only to minor changes in the formulations of the service descriptions and antecedent factors. The full online questionnaire is presented in Appendix 1.

Sample

The actual survey took place between May and June 2010 and was conducted as an open online survey. From the list of participants of one of the largest E-Government conferences, we extracted the electronic addresses of the mayors and IT executives of the 187 German municipalities with more than 50,000 inhabitants and completed these by an Internet search when necessary. Since we could not assume that the IT executives are always the right contact person for the topic of M-Government, we sent an initial invitation to the mayors' offices with a request to forward our message to an appropriate contact person. As the only incentive to participate, we offered the participants to provide them with the results of the study (which we did afterward). A few days after the initial invitation, separate reminder emails were sent to the mayors and the municipal IT executives, excluding those who had already answered. For large municipalities (i.e., those with >100,000 inhabitants) we also made reminder calls via phone. Furthermore, we answered several, mainly technical, inquiries on the phone.

Of the 187 invited municipalities, 78 representatives had begun to fill in the questionnaire. Out of these, 28 incomplete records had to be discarded, leaving 50 valid responses (response rate 27 percent) that entered the analysis. The majority of respondents (42) stated to have IT-sided roles and 8 to work on departmental side of the municipality. The distribution of city sizes and position of the respondents are presented in Figure 4.2. According to the criteria provided by (Kromrey 2006), the data can be regarded as representative sample for Germany.

Descriptive Results of Service Attractiveness

The descriptive analysis of the rated service attractiveness by mean (M) and standard deviations (SD) provides us with a detailed picture of the preferences of IT decision-makers. While the M value can be interpreted as a compound rating of the attractiveness, the SD reflects in how far the respondents agree or disagree. In the first application

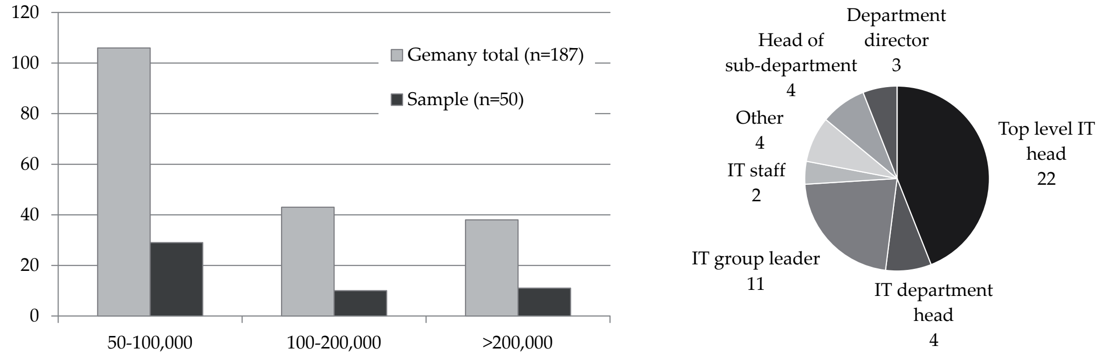


Figure 4.2: Sample description (city inhabitants and respondent position)

cluster (public administration), *mobile work management*, i.e. the use of mobile devices for data collection and disruption-free processing, for example, in the offices for food and veterinary inspections, has been evaluated with M=4.86 as the most attractive application scenario.

By far, the highest attractiveness of all applications is in *mobile firefighter support* systems. Mobile access to information such as building plans, maps, event and object information, as it is already implemented in some municipalities, is apparently considered by all municipal officials as an extremely useful application. The second-highest rating is given to *digital authentication*, which is currently expected—in combination with the electronic ID card—to allow for secure identification via telephone and Internet and thus to enable a number of new transactional E-Government services for municipalities. By far, the highest variance (SD) can be noted for *municipal wireless networks*. This possibly reflects the still different opinions regarding the economic value of publicly subsidized wireless networks (which potentially compete to commercial broadband offerings, see also Winkler et al. 2009 for a broader discussion).

Table 4.3 shows the rated service attractiveness, sorted in descending order by mean values (n=50). For brevity, here we only exhibit the top three services plus the the ones with the lowest mean attractiveness scores per application cluster. The complete list of services descriptions and attractivenesses is presented in (Ernst 2010, available on request).

4.1.6 Model Tests and Results Discussion

Methodology

We estimate and test the postulated model using the variance-based partial least squares path analysis (PLS). All calculations were performed using the software products SPSS and SmartPLS (Ringle et al. 2005). The PLS approach is particularly suitable in the present case for several reasons. First, the given question can be regarded as rather

Table 4.3: Descriptive results of service attractiveness (excerpt)

M-Government service	*M*	*SD*	M-Government service	*M*	*SD*
Public administration			**Transportation and traffic**		
Mobile work management	4.86	1.69	Mob. payment in public transport	4.48	1.53
Mobile payment at municipality	4.50	1.68	Car parking guidance service	4.42	1.75
City information services	4.48	1.59	Intelligent transport system	4.25	1.59
Mobile voting	3.04	1.70	Automatic city-toll	3.10	1.83
Public safety			**Environment and Infrastructure**		
Mobile firefigther support	5.57	1.53	Intelligent building management	4.80	1.58
Digital authentication	5.14	1.71	Intelligent street lighting	4.62	1.51
Mobile police support	4.79	1.69	Air pollution information	4.59	1.52
Person tracking	3.32	1.64	Intelligent garbage disposal	3.48	1.60
Education			**Tourism and Culture**		
Electronic library card	5.04	1.69	Mobile tourist guide	4.64	1.65
Mobile library	4.70	1.40	Mobile ticket booking	4.35	1.66
Electronic student card	3.91	1.74	Information kiosks	4.00	1.62
Educational information system	3.06	1.63	Mobile TV	2.88	1.73
Health			**Private households**		
Barrier-free accessibility	4.16	1.76	Municipal wireless network	4.74	2.02
Medical information service	3.69	1.84	Mobile services for the elderly	3.81	1.68
Mobile telemedicine services	3.69	1.87	Networked home environment	3.58	1.67
Dependents information service	3.21	1.72	Pet tracking service	2.85	1.59

exploratory since we can hardly build on existing theory. In contrast to covariance-based approaches, PLS poses no requirements for the distribution of the underlying variables and is more suitable when the focus is on theory development (Chin 1998b).

Second, the research model contains formative constructs, which are more difficult to model in classical covariance-based approaches (Panten and Boßow-Thies 2007). Hence, the variables *efficiency goals*, *innovation goals* and *IT sophistication* are constituted (i.e., formed) by the indicators operationalized in our pre-study (Section 4.1.4). Especially in research on success and influence factors, formative constructs are often better suited to represent the causal effect between indicators and the construct (Albers and Hildebrandt 2006). Consequently, the antecedent factors represent a weighted index of their substantial indicators. The weights resulting from this correspond to the beta coefficients in a standard regression model and typically have smaller absolute values than reflective indicator loads.[2]

The required sample size for testing of PLS models is not without controversy in the recent literature. Nitzl (2010) argues that PLS can deliver meaningful results even at a sample of 20 cases. On the other hand, (Marcoulides 2009) indicate that samples of

[2]It should be noted that for robustness, we also tested the model in two additional variants, with all constructs modeled reflectively as well as formatively. In neither case did major differences arise in the interpretation of the path coefficients and statistical significances, which is consistent with the observations made by (Albers and Hildebrandt 2006).

this size are not suitable to reliably detect weak path coefficients. Depending on the degrees of freedom of the model, the heuristic of Chin (1998b) has been established stating that the sample should be at least 10 times as large as the largest number of formative indicators of a latent variable, or as the largest number of predictors of latent endogenous variables. Both numbers are equal to 3 in the present model, so that with n=50 we fulfill this heuristic. We follow the approach by Chin (1998b) and assess the measurement model first before we test our model hypotheses.

Measurement Model

To assess the measurement model validity, formative and reflective constructs are to be considered separately.

Formative Constructs The formative variables *efficiency goals*, *innovation goals* and *IT sophistication* must be tested for multicollinearity (Panten and Boßow-Thies 2007). For this purpose, we calculated a Pearson correlation matrix as well as the tolerance values from reciprocal regressions for each triple of construct indicators. Despite some significant correlations of up to r=0.6, all tolerance values are well above the threshold of 0.1. This indicates that multicollinearity can be ruled out as a measurement issue for all nine indicators so that they do not need to be merged in more aggregated indices, see Table 4.4. Since formative indicators are included in the model indicators because of their content-related relevance, no further assessment of convergent and discriminant validity is required (Panten and Boßow-Thies 2007).

Table 4.4: Tolerance values of formative indicators

Efficiency goals		**Innovation goals**		**IT sophistication**	
EF1	0.619	IN1	0.624	IT1	0.503
EF2	0.634	IN2	0.662	IT2	0.390
EF3	0.845	IN3	0.484	IT3	0.391

Reflective Constructs The evaluation of the reflective variables follows according to the logic of Homburg and Giering (1996) in three steps. In the first step, exploratory factor analyzes (EFAs) are conducted with the indicators associated to each of the variables in order to potentially purify the measures and assure unidimensionality. Each indicator should exhibit a loading greater than 0.4 and no load on a second factor, and each factor should explain at least 50 percent of the variance of its associated indicators to be included in the analysis (Homburg and Giering 1996). Then, in the subsequent steps, convergent and discriminant validity can be assessed.

The variable *perceived M-Government potential* was operationalized by eight indicators, one for each application cluster. The EFA of these eight indicators shows that the perceived potential for tourism and culture (0.78) and for transportation and traffic

(0.51) clearly load on a second factor. Apparently, municipal IT decision-makers have a diverging opinion to these applications, which—arguably—lie outside the core responsibility of the municipal administration. This is, in both of these application clusters the respondents had to rate application scenarios that are much more oriented towards the private sector (e.g., mobile transport ticketing, car sharing, as well as mobile tourist guides, mobile TV, etc.). In line with (Homburg and Giering 1996), we conclude that these two indicators are not suitable for measuring the attitudes toward the potential attractiveness of mobile government as a whole and thus remove them from the analysis. The remaining one-dimensional factor explains, on average, 64 percent of the variance in the remaining six indicators.

The variable for measuring *perceived service attractiveness* is derived from list of rated services. For this purpose, we first created eight indices by averaging the indicators of the perceived attractiveness per application cluster. To ensure congruence with the (now purified) variable of *perceived M-Government potential*, we removed the indices for tourism and culture as well as transportation and traffic analogously. The EFA of this construct produces a single factor that explains, in average, 69 percent of the variance the six remaining indices.

Convergent validity of the obtained constructs is first assessed by checking the internal consistency and Cronbach's alpha. The values for both constructs are well above the required threshold of 0.7. Since alpha still depends on the number of indicators (here six), we consult the composite reliability (CR) as a further criterion, which measures how well the constructs are represented by the associated indicators. Values for both constructs are well above the threshold of 0.6 (Panten and Boßow-Thies 2007), which supports convergent validity of our measurement model, see Table 4.5.

Table 4.5: Convergent validity criteria

Construct	**AVE**	**Alpha**	**CR**
Perceived M-Government potential	0.626	0.899	0.921
Perceived service attractiveness	0.709	0.930	0.944

Discriminant validity refers to the extent to which the indicators of different latent constructs are separable. The Fornell-Larcker criterion demands that the latent variable correlations with other constructs should be less than the root of the substantively average variance extracted (AVE) (Fornell and Larcker 1981). As we can see in Table 4.6, this criterion is fulfilled for all latent variables.[3] The second criterion of discriminant validity is that the factor loadings of the indicators by their substantial constructs should be higher than the cross-loadings from other constructs, which is also fulfilled.

Common Method Bias and Demographic Distortions In order to assess whether a majority of the observed variance results from the measurement method (i.e., common

[3]For formative constructs, this criterion is not applicable and has only been demonstrated to demonstrate robustness in the reflective case.

Table 4.6: Discriminant validity criteria (reflective case, root AVE on diagonal)

	EF	IN	IT	MP	SA
Efficiency goals (EF)	**0.790**	–	–	–	–
Innovation goals (IN)	0.390	**0.826**	–	–	–
IT sophistication (IT)	0.382	0.264	**0.888**	–	–
M-Government potential (MP)	0.466	0.512	0.532	**0.791**	–
Service attractiveness (SA)	0.428	0.355	0.412	0.812	**0.842**

method bias), we performed a one-factor test according to Harman (1976). The test, i.e. an EFA with all model variables, resulted in five distinguishable factors that reflect the five factors of our model, whereas the first factor explains only 31 percent, rather than the majority, of the total variance in the model. This suggests that the presence of a common method bias can not be the main reason for the correlations in the measurement model (Podsakoff and Organ 1986).

To assess whether a distortion of the variables results from demographic characteristics in our sample, we performed pairwise Spearman rank correlation tests of the variables of the measurement model and the number of the inhabitants, as well as other characteristics of the respondents. Contrary to the observations made by (Moon and Norris 2005), we find no significant correlation between the size of the municipality and the measured variables. The same applies to the respondent demographics.

Structural Model Assessment

The results of the PLS analysis are presented in Figure 4.3. Statistical significance was assessed by t-tests based on a bootstrap procedure with 5,000 resamples. To evaluate the results, the explained variances R^2 and path coefficients can be interpreted similar to those in the simple regression (Panten and Boßow-Thies 2007). We begin our interpretation with the hypothesized antecedent factors.

The results support the hypotheses that *innovation goals* (**H4**) and *IT sophistication* (**H5**) are positively related with the *perceived M-Government potential*. Based on the available data, the impact of *IT sophistication* can be viewed only as slightly stronger. This finding provides a strong indication that those municipalities are primarily motivated for M-Government which also have a a more general ambition to implement innovations in E-Government. M-Government therefore can not be viewed as an isolated part of the municipal technology strategy, but rather adds up to other E-Government activities. In this regard, the incentive to offer new services and respond to changing customer needs (i.e., innovation goals) and past experience in E-Government (IT sophistication) play an almost equally important role.

However, albeit a path coefficient of 0.19, we find no significant support for influence of efficiency goals (**H3**, t=1.56). According to our nomological framework, this means that, although many M-Government applications obviously aim at process support, efficiency improvements and the bilateral benefits for citizens and administrations, this potential

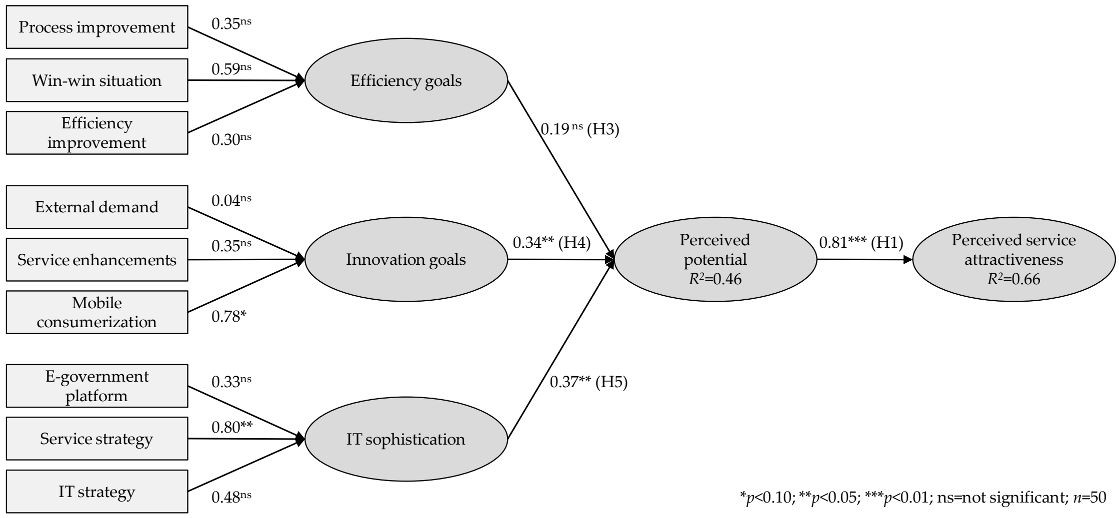


Figure 4.3: Structural model results

is not (or at least not strongly) associated with the general perceived potential of M-Government. In other words, *efficiency goals* seem to be not (yet) a strong driver for positively evaluating the general M-Government potential and thus neither for planning concrete service implementations.

Altogether the antecedent factors explain R^2=46 percent of the variance in *perceived M-Government potential*, which can be interpreted as a good level of determination given the exploratory direction of this study (Homburg and Giering 1996). The *perceived M-Government potential* mediates the influence of the antecedent factors on the *perceived service attractiveness*. With a path coefficient of 0.81, it is strongly and significantly associated with the *perceived service attractiveness* (**H1**). This strong coefficient appears remarkable, given that these two constructs originally point at two different conceptual and nomological levels (i.e., one at the *general* perception of M-Government as a phenomenon, and the other at an aggregate measure of the attractiveness of a number of *concrete* application scenarios). This, and the R^2=66 percent of variance explained in *perceived service attractiveness*, indicate that *perceived M-Government potential* is a reliable predictor for the concrete evaluation of a broad spectrum of M-Government services. This also underlines the high level of content congruence and statistical validity of these two novel constructs.

Cluster Analysis

The different influences exerted by the antecedent factors—which are only partly consistent with the results of our qualitative pre-study—may indicate heterogeneous motivational structures of the municipalities in our sample. As some authors note, existing heterogeneity in a sample may be obscured in the aggregation of an unidirectional regression model (Backhaus et al. 2003, p. 511). Such information may be recovered by an a-posteriori segmentation of the sample into smaller groups. We perform such analysis by a Ward's hierarchical clustering based on the linkage of the (standardized) factor scores of the antecedent variables *efficiency goals*, *innovation goals* and *IT sophistication*. Examining the gradient of the distance measured over the clustering steps, we note a strong slope change of the cluster distances when reducing from four to three clusters. Hence, we set the optimal number of clusters to four. The resulting clusters with different sizes may be labeled according to their characteristic mean factor scores as: Innovators (n_A=8), IT experienced (n_B=6), Efficiency-oriented (n_C=23), and Laggard municipalities (n_D=13), as depicted in Figure 4.4.

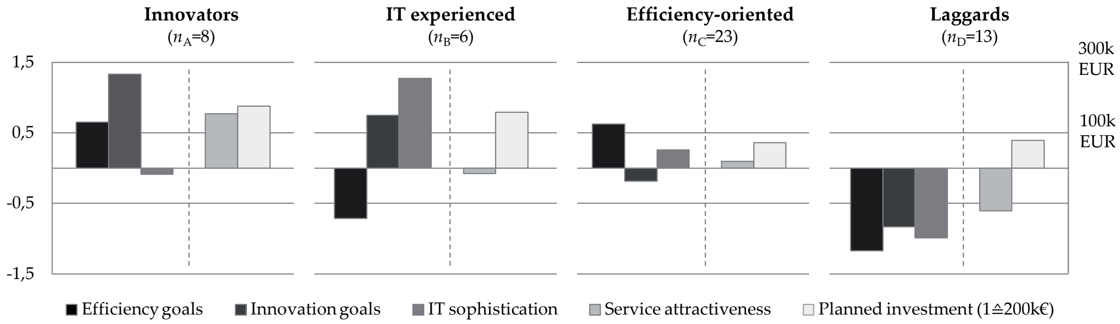


Figure 4.4: Mean factor scores per municipality cluster

We may call such municipalities *Innovators* that see themselves particularly sensitive to the expectations of their customers and hence, besides striving for operational efficiency, draw new ideas for M-Government services and applications from the goal to innovate. Apparently, this may not necessarily be the municipalities with the highest level of IT sophistication. In contrast, *IT experienced*[4] municipalities seem to have a good basis for innovative IT projects, yet no urgent efficiency goals. These municipalities potentially still perceive a lack of attractive services offerings (see also next subsection). The largest segment can be classified—probably the light of their budgetary situations—as *efficiency-oriented* municipalities, which must limit their IT expenditures to the bare essentials and thus are motivated rather moderately for M-Government endeavors. The cluster of municipalities that exhibit a below-average level of all three drivers can be characterized as *Laggards*. These communities are evidently behind the other three groups in the process of innovation diffusion and M-Government adoption.

Relationship between Goals, Perceived service attractiveness and Investment Behavior

To test the postulated relationship between the motivational structure of municipalities and the perceived service attractiveness (**H1**) on the one hand, and the planned invest-

[4]Note: This cluster has been termed *IT experienced* (instead of *IT sophisticated*) for better coherence with the original version of this paper, which has been published in German.

ment in M-Government (**H2**) on the other hand, we perform an analysis of variance and test post-hoc whether the identified clusters differ significantly from each other regarding the factor means (M) of the target variables (see Table 4.7).

In terms of *perceived service attractiveness*, it shows that the null hypothesis of equal cluster group means can be refuted (F=3.73; p=0.02). To determine between which clusters these differences exist, we perform post-hoc tests using to Fisher LSD (least significant difference) tests. At a p<0.1 confidence level, we find that innovators differ significantly in their perceived attractiveness (M_A=0.77) from efficiency-oriented (M_C=0.10; p_{AC}=0.08) and laggard municipalities (M_D=-0.61; p_{AD}=0.02). Efficiency-oriented and Laggards also differ significantly from each other (p_{CD}=0.04). IT experienced municipalities exhibit a slightly below-average perceived service attractiveness (M_B=-0.08) and no significant group mean differences from any of the other clusters, which indicates a high variance within this cluster.

The analysis of variance also indicates unequal group means across clusters in terms of the *planned investment* (F=2.54; p=0.07). LSD post-hoc tests show that innovators (M_A=175,181 EUR) differ significantly from Laggards (M_D=78,680 EUR; p_{AB}=0.06) and from Efficiency-oriented (M_C=71,543 EUR; p_{AC}=0.03). The latter also fall significantly below the level of investment of the IT-experienced municipalities (M_B=158,333 EUR; p_{BC}=0.09).

Table 4.7: Municipality clusters and group differences

		Cluster variables			**ServAttract**		**Investment**	
Cluster	n	EF	IN	IT	M	LSD[a]	M (EUR)	LSD[a]
Innovators (A)	8	0.65	1.33	-0.09	0.77	C, D	175,181	C, D
IT experienced (B)	6	-0.71	0.75	1.27	-0.08	–	158,333	C
Efficiency-oriented (C)	23	0.62	-0.19	0.26	0.10	A, D	71,543	A, B
Laggards (D)	13	-1.17	-0.83	-0.99	-0.61	A, C	78,680	A

[a]Group differences assessed by Fisher least significant difference post-hoc tests, p<0.10

4.1.7 Conclusion

Based on the attitudes of municipal IT decision-makers, this study indicates that there is a link between organizational goals of a municipality and the perceived attractiveness of novel M-Government services as well as the municipality's investment intentions. Representing a sum of opinions, we argued theoretically that the extent to which such strategic goals are pursued by the IT decision-maker lead to varying degrees of motivation for or against introducing M-Government applications. Based on the literature and a series of interviews, we typologized and operationalized such strategic conditions in a triad of *efficiency goals*, *innovation goals*, and *IT sophistication*. The results of an empirical study and PLS path analysis support a significant influence of the latter two factors, suggesting that municipalities possess heterogeneous profiles regarding their motivational structures. This view is supported by a post-hoc cluster analysis, in which we discovered four types of motivation profiles: Innovators, IT experienced, Efficiency-oriented and Laggards. In regard to the dependent variables, we were able to show that, within the next three years, Innovators and IT experienced plan to invest about the double in M-Government services compared to Efficiency-oriented and Laggard municipalities. Also it seems that particularly IT experienced municipalities—based on the assessment of the 60 potential services and applications in our study—still perceive a relative lack of attractive M-Government service offerings.

Implications for Practice

The findings in this study not only provide relevant implications for the public administrations, but also for service providers and the political level. First, we demonstrate that—similar to private sector organizations (Rogers 1962)—cities possess heterogeneous innovation profiles. Unlike private businesses, however, municipalities are facing far less competition. Therefore it appears reasonable that the experiences made by Innovator and IT experienced municipalities serve as an example for the large group of non-innovators and that a knowledge transfer takes place. Therefore, municipal IT decision makers can use the proposed typology and clusters to determine the role and position of their own municipality within the (M-Government) innovation adoption process. Although our subject of study focused on innovations particularly in M-Government, we put forward that the presented model of antecedents factors and investment outcomes is also applicable to other technological and organizational innovations in public administration.

Furthermore, our work provides a comprehensive overview about the service offerings that are most attractive for investment from the perspective of municipal IT decision makers. This not only provides guidance for political stakeholders, but also serves as a valuable market information for private service providers that push into this young segment of the E-Government market. A point we view critically, however, is the relatively large cluster of Laggard municipalities with their below-average motivational profile for all three dimensions, along with the finding that efficiency goals (so far) are not significantly related to M-Government adoption. This suggests that M-Government is generally not (yet) viewed as a route to greater efficiency in public administration, but rather as a 'luxury' for those customer-oriented governments which can still afford to realize innovative E-Government projects. This in turn raises the question whether the political level should enforce certain mobile service offerings (e.g., those rated with a high attractiveness in our survey) and/or according standards to a greater extent, as it has been done in the past, for example, in the implementation of the EU Services Directive and the electronic identity card.

Limitations and Future Work

A few limitations of this study merit consideration when interpreting the findings. First, we tried to counteract the inherent limitation of generalizability by addressing a representative sample of cities across Germany. A second limitation is given by the—despite the good response rate of 27 percent—relatively small sample size. As discussed in Section 4.1.6, a greater sample size may have led to better statistical significance of the endogenous model factors (in particular efficiency goals).

Further, it was assumed that the evaluation by an individual IT decision maker sufficiently reflects the sum of the opinions of relevant stakeholders in a municipality. This may have led to measurement errors especially for large municipalities. In addition, our theoretical framework and the presented research model unavoidably represent a gross simplification of reality. In order to address the latter two limitations, we asked the respondents at the end of the survey for their willingness to participate in a secondary, more qualitatively-oriented study. In this way the authors hope to identify further influencing factors for M-Government on a more fine-grained level and contribute these to the body of knowledge in a future research.

Despite these limitations, this work provides a relevant contribution by being one of the first empirical studies that directs the focus of M-Government adoption on the relevant decision makers in municipal administrations. For this purpose, we used a comprehensive conceptualization and operationalization of M-Government which explicitly does not neglect the internal, efficiency-oriented perspective on M-Government benefits. Altogether, this work complements and enhances the common end-user level M- and E-Government research streams by taking an organization-oriented approach to study this highly relevant phenomenon.

4.1.8 Summary

Municipalities face increasing fiscal stress and the pressure to save on costs. At the same time, with the growing popularity of the mobile Internet, new innovative application scenarios of 'Mobile Government' (M-Government) are emerging. In this chapter we analyzed a broad spectrum of M-Government services from the perspective of municipal IT decision-makers and investigated the organizational factors that influence the perceived attractiveness of these services. Based on the extant literature and a series of interviews, we developed a model that proposes three main motivational dimensions (efficiency goals, innovation goals, and IT sophistication) to affect municipal mobile government adoption. We tested the model empirically in a survey with 50 German municipalities by using a partial least squares path modeling technique and clustered the cases according to the proposed dimensions. The results indicate that municipalities with a high degree of perceived M-Government service attractiveness differ significantly from those with a low degree. Based on these findings, we argue that municipalities can be characterized either as Innovator, IT experienced, Efficiency-oriented, or Laggard types regarding their motivational structures.

4.2 Towards Transformational IT Governance

4.2.1 Preamble

This chapter has been published earlier as a conference paper at the 19th European Conference on Information Systems (ECIS), June 2011 in Helsinki (see Winkler, Lvova, and Günther 2011b) and as an extended version in (Winkler 2012)

4.2.2 Introduction

With the rise of the mobile internet, smart internet connected devices are becoming part of our everyday life. The fact that in many countries mobile broadband penetration has already surpassed fixed broadband subscriptions may only serve as a rough indicator (ITU 2010). Just as for private businesses (e.g., Siau et al. 2001), these technological advances also offer the possibility for public sector institutions to rethink the interaction channels with customers as well as with employees and enhance current e-government practices by appropriate mobile government (m-government) services (Kushchu and Kuscu 2003; Trimi and Sheng 2008).

However, such enhancements may imply transformational steps and require fundamental changes to internal organization and governance (Weerakkody et al. 2007; Janssen and Shu 2008) so that, analogously to private economy, public sector institutions take a different pace in innovation diffusion (Winkler and Ernst 2011). Drawing on findings from a recent survey, our research question is: What exactly makes public sector organizations differ in their adoption of mobile government services? Present literature tends to focus rather on technocratic aspects of m-government adoption, often lacks in empirical foundation and is hardly able to embrace the relevant contextual differences between the objects of analysis (e.g., Kushchu and Kuscu 2003; Sandy and McMillan 2005; Al-khamayseh et al. 2006; Kushchu et al. 2007; Kumar and Sinha 2007; El-Kiki and Lawrence 2007). We combine grounded theory and quantitative content analysis to develop a comprehensive framework on m-government adoption and apply this framework in four cases to determine the relevant contingencies in this context.

This chapter contributes to current research inasmuch as a) we empirically derive factors which influence m-government adoption and b) generate appropriate theory to explain differences in the adoption between different entities. Since mobile government initiatives primarily occur at the local level (Borucki et al. 2005), we chose the municipal decision makers as the object of analysis. In the remainder of this chapter we first review related work. Then we explain the methodological approach in Section 4.2.4. Section 4.2.5 presents the derived adoption framework which is then used for the comparative case studies in Section 4.2.6. Section 4.2.7 summarizes the results and proposes future work.

4.2.3 Related Work

Mobile Government Adoption

Following the definition by Kushchu and Kuscu (2003), m-government can be defined as a strategy and its implementation involving the utilization of all kinds of wireless and mobile technology, services, applications and devices for improving benefits to the parties involved in e-government. Akin to e-government, m-government may have different foci. For the purpose of this work we distinguish between three main interaction patterns: government-to-citizen (G2C), government-to-business (G2B), and government-to-government (G2G) (Trimi and Sheng 2008). Although rarely causing structural changes (Borucki et al. 2005), the use of mobile technology may still help to transform governments (Kumar and Sinha 2007). In this sense, m-government may be related to the upcoming research stream of transformational government (Irani et al. 2008; Weerakkody et al. 2008).

Challenges and success factors of m-government adoption are widely discussed in e-government research (see Napoleon and Bhuiyan 2010 for an overview). As the most critical issues, privacy and security as well as accessibility concerns are frequently mentioned (Kushchu and Kuscu 2003; Sandy and McMillan 2005; Al-khamayseh et al. 2006; El-Kiki and Lawrence 2007; Kushchu et al. 2007; Kumar and Sinha 2007). Moreover, we find a long list of technical issues related to infrastructure development, payment infrastructures, and compatibility as well as legal issues (Kushchu and Kuscu 2003; Kushchu et al. 2007), and user-related issues (such as preferences, quality, user friendliness, convenience, acceptance and education) (Sandy and McMillan 2005; Al-khamayseh et al. 2006; El-Kiki and Lawrence 2007) as well as cost (Sandy and McMillan 2005) as critical factors for mobile government adoption.

However, the rather young literature on m-government mostly draws upon conceptual work and single case studies and still lacks empirical foundation (Napoleon and Bhuiyan 2010). Thus, adoption factors identified in existing research can provide general normative guidelines, but do not to account for the individual differences between organizations. A recent study by Winkler and Ernst (2011) indicates that public sector institutions differ in innovation adoption. They segment municipalities into four empirical clusters: the *Innovators*, *Hybrids*, *Efficiency-oriented* and *Laggards*. Out of these clusters, only the former two may be considered as early adopters. In this chapter, we build upon this classification to explain the differences between such public sector organizations.

IT Governance in the Public Sector

One major barrier for m-government adoption also stated by experts refers to governance during initiation of an m-government project (El-Kiki and Lawrence 2007). Governance has equally been mentioned as one of the core elements in government transformation (Janssen and Shu 2008). From an organizational standpoint, any public institution can be horizontally divided in departmental areas and central units that perform cross-functional

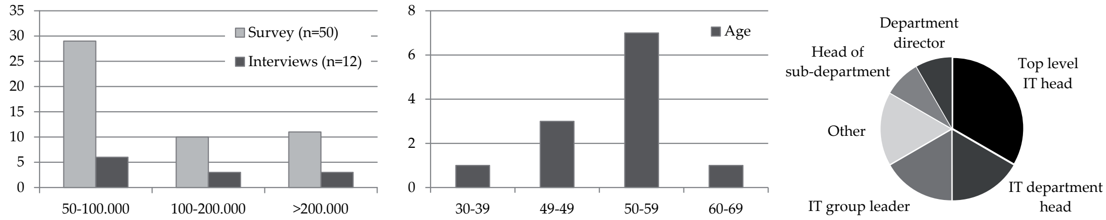


Figure 4.5: Interview sample description

tasks such as information systems management (Brown 1999). A core aspect of IT Governance is to define the distribution of decision-making authority and responsibilities between such entities. Patterns for the distribution of decision-making authority can be roughly classified into centralized, decentralized and federal archetypes (Sambamurthy and Zmud 1999; Weill and Ross 2004a).

Governance mechanisms, which can be implemented at structural, procedural and relational level, have been identified as a key to align IT with business organizations and achieve IT performance in private sector companies (e.g., Weill and Ross 2004a). Yet, little research has been conducted on mechanisms that contribute to IT governance within public sector organizations (Ali and Green 2007). For instance, in a cross-industry survey reported by Weill (2007) public sector organizations clearly score the lowest IT governance index. This topic is recently also gaining practical relevance (e.g., Hoch and Payán 2008), as the fundamental differences between public and private sector may also call for different principles of IT governance (Sethibe et al. 2007).

4.2.4 Research Method

Data Acquisition

We acquire data from 12 in-depth semi-structured interviews with municipal IT decision makers. This object of analysis appears particularly suitable, since most m-government initiatives occur at the local level by the involvement of very few departments and workers, as Borucki et al. (2005) note. Interview contacts have been drawn from a prior survey, which features a representative sample of German municipalities (n=50) Winkler and Ernst (2011). Interviews took place between June and August 2010 and followed a common guideline (a. context, b. mobile applications c. drivers and inhibitors, d. stakeholders). Average duration of an interview was 54 minutes amounting to 10.8 hours total interview data, respectively 140 pages of transcription. The city size, demographics (100% male) and job positions of the interviewees are depicted in Figure 4.5.

Coding Procedure and Content Analysis

We combine grounded theory with quantitative content in a five-step approach to analyze the interview material. Grounded theory is contrary to other research methods as it seeks to systematically develop theory, rather than verifying or testing it (Strauss and Corbin 1998; Glaser 1992). Straussian grounded theory follows an interwoven process of open coding, axial coding and selective coding. It is thought to be more prescriptive compared to the Glaserian approach (van Niekerk and Roode 2009). Our coding and calculations were performed using a software for qualitative data analysis (Atlas.ti) as well as a common spreadsheet program.

1. We incrementally performed open coding of the given interview material by two coders and retrieved an initial list of 173 codes. Average groundedness of a code, i.e. number of quotations, is 8.3. Each code captures in average 28.3 words, which is a calculatory 53% of the total interview material.

2. Deviating from the Straussian procedure, we first arranged these codes according to basic categories (coding paradigm), before aggregating codes to mid-level concepts and categories. As the core phenomenon (the adoption of m-government services) was clear from the beginning of this study, we use an adapted Strauss coding paradigm (Strauss and Corbin 1998), which jointly interprets causal and intervening conditions as *drivers* (i.e., conditions with a positive influence) and *inhibitors* (i.e., conditions with a negative influence). The resulting coding paradigm is illustrated in Figure 4.6.

3. We merged codes according to perceived semantic distance and partly sorted out codes with very few quotations. Simultaneously, appropriate mid-level categories were found within two of the basic categories to semantically structure these concepts. The result is a condensed hierarchical framework with total 42 concepts in four categories (see Figure 4.7).

4. We determined the intercoder reliability (Neuendorf 2002) of the condensed code set by recoding a sample of three interviews with switched roles. We considered an overlap in the quotation in both document versions as a *hit*, and calculated the reliability according to the formula $r = 2 \times hits \ / \ (\ total\ codes_{Coder\ A} + total\ codes_{Coder\ B})$. The resulting reliability of 58% can be regarded as a good result considering the number of different codes. For the subsequent analysis we joined both codings to a consolidated version.

5. For a valuation of the conditional variables, both of the coders went through all quotations belonging to the conceptualized conditions. We rated the relevant 1,273 quotations on a three-point scale, where -1 represents an inhibiting, 0 a neutral, and +1 a driving influence on m-government adoption. The reliability of this rating was κ=78% measured by Cohen's Kappa, which can be regarded as a very good agreement (Neuendorf 2002, p. 141). We calculated the influence of each variable as the average ratings of both coders. For the purpose of illustration, the resulting valuations have been transformed to an equidistant five-step scale (interval boundaries at -1.0; -0.6; -0.2; 0.2; 0.6; 1) where "$--$" represents a strong inhibitor, "$-$" a weak inhibitor, "$\bigcirc$" a neutral influence, "+" a weak driver and "++" a strong driver.

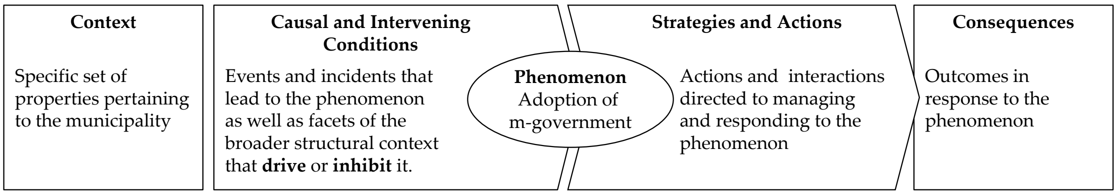


Figure 4.6: Adapted coding paradigm from Strauss and Corbin (1998)

Case Study Approach

To investigate the variance in m-government adoption more in detail, we selected four cases from the sample. In qualitative research, the selected cases should be especially critical or revelatory with regard to the phenomenon (Benbasat et al. 1987; Merriam 1998). The replication logic either dictates to select cases which are expected to yield similar results (*literal replication*), or opposite results (*theoretical replication*) (Yin 2003, pp. 46-53). In this research, we followed the latter approach and based our case selection on three main considerations. First, we decided to choose one case from each of the empirical clusters provided by Winkler and Ernst (2011), as these groups emerged from statistic clustering which generally enhances variance. Second, within these clusters we preferred such revelatory cases which are characterized by a good clarity, quality and openness of the interviewee. Third, as selection should also be based on organizational criteria (Benbasat et al. 1987), we took into account municipality sizes and selected two larger and two medium sized cities. This allows for both, pairwise comparison and testing for size differences between these cases. Furthermore, we complemented the analysis with relevant documentation, such as strategy documents, organization charts and press clippings which we additionally retrieved from interview partners and web sources.

4.2.5 Framework for Mobile Government Adoption

The developed framework saturates the theoretical categories from Figure 4.6 with appropriate concepts that play a role in m-government adoption. Figure 4.7 displays the results of the qualitative analysis with total code frequencies and valuations in brackets. The code frequency (#) can be interpreted as the relative importance of a concept, while the valuation (+/−) describes the strength of driving and inhibiting influences. For reasons of brevity, we briefly describe the main concepts in the following.

Contextual Variables

Contextual variables, on the one hand, refer to properties of the municipality such as *size*, *economic profile* and *budgetary situation*. On the other hand, we found properties of the municipal IT organization and IT architecture to be relevant for m-government adoption. Examples are *horizontal distribution* of the IT organization, the *degree of*

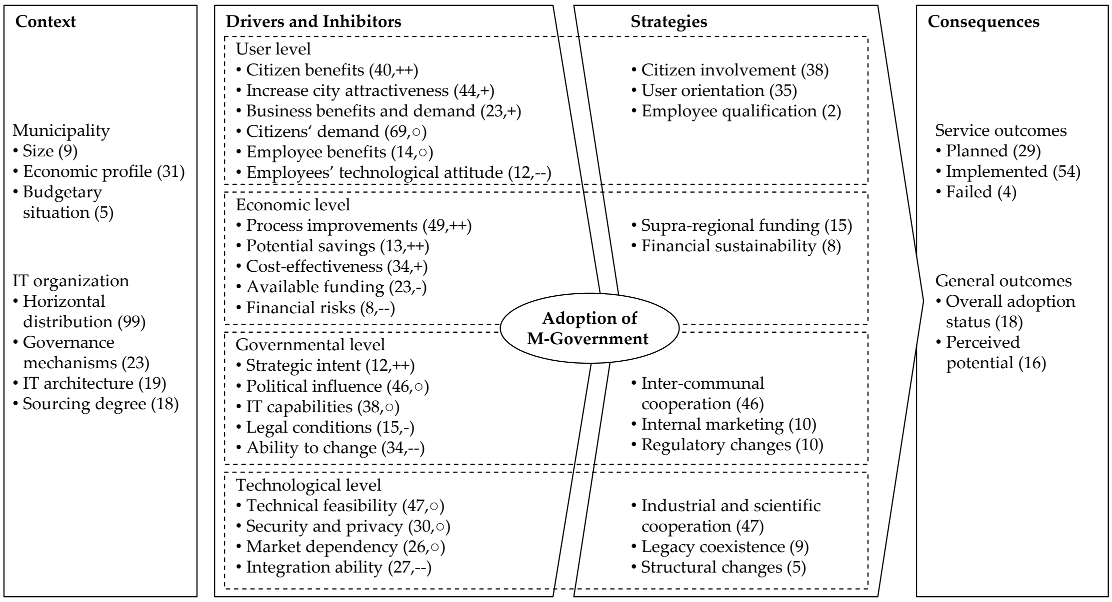


Figure 4.7: Framework for m-government adoption

external sourcing, as well as *governance mechanisms* which are used to integrate IT with the functional departments. The complex influence of such variables should be elicited by the case studies presented in Section 4.2.6.

Drivers, Inhibitors and Strategies

Drivers and inhibitors are the factors that have either positive or negative influence on the municipality's decision on mobile government adoption. Strategies are the actions that are taken in response to drivers and inhibitors. In the interviews, these actions have been identified by key words such as "need/should/must be done". To group drivers, inhibitors and strategies, four self-evident levels emerged as categories: user, economic, governmental and technological level.

User Level On user level we mainly find drivers which relate to the *expected benefit* of m-government for the three target groups (citizens, businesses and governmental employees). Some cities also aim to *increase* their *attractiveness* by offering mobile services, while others clearly doubt such kind of impact. The highest group-specific *benefit* is perceived *for citizens* who will be able to use a new channel of communication and interaction with their municipality. However, some interviewees also note that there is a considerable lack of knowledge on what the *citizen demand.* A similar pattern can be observed regarding government employees. Some *employee* groups see a clear *benefit* in the use mobile technologies in their daily work routines while others fail to adopt these due to their *technological attitude.*

Consequently, the most important strategies to ensure a later user acceptance are to *involve citizens* at an early state and to focus consequently on the target group during the implementation of a new service (*user orientation*). Training the employees (*employee qualification*) however, has only been mentioned few times. Regarding the business target group, there seems to be a slightly different relationship. In case local businesses see a clear benefit for a certain service, e.g. for mobile billing or parking, they will immediately utter such demand, so that *business benefits and demand* represent both an (even though weak) driver.

Economic Level Not surprising, all interviewees put large emphasis on economic aspects, so that we applied a semantically rather fine-grained code set at this level. In the first place, possible *process improvements,* e.g. by increasing level of information and throughput times, are mentioned to be a key driver for m-government. Such improvements may further lead to improved *cost-effectiveness* and *potential savings.* However, as some interviewees comment, not all process improvements pay off on the budget side, as freed resources are often immediately consumed by other tasks or an increased demand in the new service.

Surprisingly, *availability of funding* is only a light inhibitor for the municipalities. The rationale behind this is that a good application will automatically pay off, so that costs are to be seen as an investment rather than expenses. Therefore, *financial risks* play a stronger yet not very prominent role as an inhibitor in such investments. Strategies to ensure the economic success of such project are access to *supra-regional funding* (e.g., on federal or EU level) and a focus on *financial sustainability* on the whole.

Government Level On governmental level we find strong drivers as well as strong inhibitors. Few interviewees quote a certain *strategic intent*, i.e. a strategic vision and creativity of the municipality in the use of new technology, as well as the *capabilities of their team* (to a smaller extent) as important drivers. But rather than relying only on their internal capabilities, most municipalities strongly refer to their network of *inter-communal cooperation* to share experiences and drive diffusion. Such networks can be formed by clusters of cities as well as cooperation of public service providers.

Political influence seems to be a double-edged sword. On the one hand, political bodies need to be arduously convinced (*internal marketing*) to commit to technologically enabled changes. On the other hand the interviewees report that larger transformations can much easier e implemented once there is a political will. However, if such political will is not present (which is mostly the case), the *ability to change* within the municipal administration can become a major inhibitor. Furthermore, *legal conditions* concerning data security, laws, as well as different legal standards between authorities and federal states are an issue. This obstacle, in some cases had, in other cases still may to be overcome by appropriate *regulatory changes.*

Table 4.8: M-government service outcomes

	Citizens / businesses (G2C/G2B)	**Government** (G2G)
Planned	• Mobile city portal (2) • Mobile library services (2) • Mobile tourist guide (1) • Problem reporting service (1) • Mobile payment platform (1)	• Traffic warden support (3) • City council support system (2) • Civil engineering support (1) • Public order office support (1) • Retirement homes control (1) • Environment agency support (1)
Implemented	• Mobile city portal (4) • Single service number[5] (4) • Mobile parking tickets (2) • Public transportation information (1) • Public transportation payment (1) • Parking information service (1) • Appointment service (1)	• Traffic warden support (2) • Food inspection support (2) • City council support system (1) • Veterinary services support (1) • Firefighter support (1) • Mobile radar equipment (1)
Failed	• Live townhall meetings (1) • City Wi-Fi services (1) • Car sharing service (1)	–

Technological Level Regulatory changes are also related to technological influences, especially *security and privacy* standards that municipalities need to comply with. However, stronger inhibitors on technological side refer to the *feasibility*to implement new technical solutions and *dependency on the market.* Deciding for a certain technology may lead to a lock-in to certain vendors. The *ability to integrate* mobile applications with existing procedures also fails due to a lack of open standards (e.g., web services) in existing applications.

Several municipalities address feasibility issues through strategies of *cooperation with industrial partners* or *research institutions* to stay informed about the state of the art. To minimize technological risks, also a *coexistence* of the mobile process with the legacy system is proposed. Yet, this strategy generates additional costs. Finally, some IT leaders mention the need to *structurally change* the IT landscape in order to be able to integrate with mobile channels.

Consequences

We divided the consequences of M-Government adoption into *service outcomes* and *general outcomes.* Concerning the latter, most IT decision-makers generally see a high *potential* in m-government possibilities and expect an increasing relevance of this topic in the next two to three years. However, the *perceived adoption* status differs. While some municipal representatives admit not having ventured any project with respect to mobile government, others consider themselves to have a stronger expertise and experience.

We found these perceptions generally reflected in the number of service outcomes observed which refer to the concrete mobile services which have been *planned*, *implemented* or *failed*. Service outcomes are presented in Table 4.8. Here, the numbers in brackets correspond to the number of municipalities in the sample (n=12). We acknowledge that these numbers serve as a rough indicator as interviewees might forget to mention a certain service during an interview. We find that there are some common (planned or implemented) applications across cities, e.g. the implementation of mobile city portals, traffic warden support, single service number[5] and mobile parking tickets. Other services, by contrast, seem to be piloted largely by the initiative of individual cities.

4.2.6 Mobile Government Cases

To better understand the differences between municipalities we use the presented framework to conduct multiple case studies following the methodology and selection criteria outlined in Section 4.2.4.

Case A: An M-Government Innovator

Case A is a city with more than 500,000 inhabitants in one of the economic centres in Germany and considers itself to be a leader in e- and m-government. The IT department is subordinate to the general office for central services and can be divided into two subunits: the department for IT operations and the office for organization and IT steering. Further, in course of the EU services directive[6], e-government has been given a high priority through establishing an additional inter-disciplinary Competence Centre within the Department for Economic Development. The interface to the departmental areas is provided by a decentralized liaison role. Initiatives for new IT projects, such as mobile services, may be filed by the departmental areas and evaluated by central IT steering, which governs the IT budget. The city has outsourced data centre operations, networks and communication infrastructure and large parts of application management to a communal IT service provider.

The Head of Organization and IT steering sees the main benefit of mobile services particularly on citizen and internal side. Mobile applications, such as an appointment service or the ex-ante completion of required forms, may reduce citizens' attendance at public bodies, but also efforts for the municipality. This tendency is seen as an important building block for increasing city attractiveness embedded in a comprehensive strategy of urban development. Same applies to local businesses, where the facilitation of routine interactions with the municipality may become an "absolute location factor". Economically, such applications should account for their costs, however, some applications which focus more on quality usually pay off only in the long run. Thus, almost

[5]The single service number (D115) represents an exception inasmuch as it results from a Federal initiative of the Ministry of the Interior and is gradually rolled out nationwide. Also, the classification of this service as M-Government may be debatable.

[6]The EU directive on services in the internal market (2006/123/EC) has been issued with the objective of establishing a single market, and amongst other requires governments to provide a "point of single contact" via electronic means.

everything which is technically feasible will be evaluated in the light of the IT strategy and municipal goals. Possible internal resistance to changes can widely be mitigated through the central empowerment of the office for organization and IT steering within the municipality administration.

The only restrictions from this perspective are technical possibilities and certain legal regulations, such as data protections laws. On the technical side, the interviewee states that most internal procedures and applications—contrary to a service-oriented paradigm—yet do not offer the possibility to be opened towards the (mobile) Internet. Thus, on both issues more nation-wide standards, as occurred for example with the introduction of the electronic ID[7], would be appreciated to avoid redundancy. The municipality actively cooperates with industry, such as a local telecommunication company, as well as with local research institutions. As an outcome, the city offers and operates a number of external and internal mobile services, which enjoy a high acceptance among their users, see Table 4.9.

Case B: An IT Experienced Municipality

As case B, we chose a medium-sized city in Southern Germany with a structurally challenging but relatively dynamic economic environment. Our interviewee is the head of an e-government staff function, which has been installed to coordinate between the municipal demands, internal IT and a communal IT services provider. Like in case A, the link to the departmental areas is provided by IT liaison roles that manage day-to-day operations. On the strategic level, there is an IT steering committee meeting every 4-6 weeks and comprising members from the departmental areas, staff council, auditing and internal IT. This committee decides on new and ongoing IT projects and only needs the city council's approval beyond a certain investment volume.

The driver for m-government is mainly seen in the benefit for local industries. These industries deservedly claim appropriate interfaces to simplify their own processes, e.g. for switching from a single to a collective billing for parking services. On the contrary, the interaction with citizens is characterized by consumption and creation of a benefit that is "hardly quantifiable". Moreover, the interviewee reports on difficulties in recognizing the citizen demand, as the demands of single interest groups cannot necessarily be understood as a collective need. On the economic level, the importance of a payment platform is stressed, hence only such services will be implemented which directly pay off, e.g. an on-demand provision of geo-data. However, implementing projects just for the sake of the city's image "was something for the 90's", rather the city puts emphasis on the sustainability of the solution and pursues long-term partnerships with various industry partners.

On the governmental level we find interplay of sound internal IT capabilities and

[7] Germany has launched a new electronic ID from November 2010 onwards, driven by an initiative of the German Ministry of Interior, the Federal Office for Information Security and multiple research and industry partners.

Table 4.9: M-government cases overview

	Case A **Innovator**	**Case B** **IT experienced**	**Case C** **Efficiency-orientd.**	**Case D** **Laggard**
Municipality				
Size[a]	Very large	Medium	Medium	Very large
Budget and empl.[b]	2,500 mn Eur; 9,000 empl.	500 mn Eur; 4,000 empl.	300 mn Eur; 1,000 empl.	2,500 mn Eur; 9,000 empl.
Financial situation	Moderate	Moderate–poor	Poor	Moderate
IT organization				
Budget and empl.	20 mn Eur; 300 empl.	6 mn Eur; 60 empl.	6 mn Eur; 8 empl.	10 mn Eur; 250 empl.
Hor. distr.	Centralized	Centralized	Centralized	Decentralized
Structural mechs.	Major decision rights on IT Steering side	IT Steering Meeting	Idea Mgmt process, IT Steering decisions	IT Steering Meeting, IT Planning Group
Sourcing	High	Medium	Very high	Very Low
User level	++	+	+	○
	+ Citizen demand + Business demand + City attractiveness	+ Business benefits − Lack of knowledge on citizen demand	+ Business demand ○ Citizen demand	+ Ideas from departments ○ Citizen demand
Economic level	+	++	++	○
	+ Effort reduction + Process improvements + Long-term benefits	+ Cost-effectiveness + Co-financing from supra-regional level	+ Process improvements + Cost savings ○ Financial risks	+ Goal to save costs − Ability to save costs
Govern-mental level	+	+	○	−
	+ IT capabilities − Legal barriers ○ Resistance to change	+ IT capabilities + Political influence − Legal barriers	○ Political influence	− Lack of alignment − Internal resistance − Political instability
Techno-logical level	−	○	○	○
	+ Nation-wide standards − Integration ability	+ Market solutions − Authentication	○ Security and privacy − Technical coexistence	− Operational problems
Service outcomes				
Planned	• Library services • Problem reporting • Elderly homes control • Environment insp.	• City portal • Payment platform • Library services • Tourist guide	• Councillor support	n/a
Imple-mented	• City portal • Appointment service • Parking information • Food inspection	• Parking information	• Traffic wardens • Food and veterinary inspection	• City portal • Radar control • Parking payment
Failed	n/a	n/a	• Live townhall meetings	n/a
General outcomes	Currently: information provision, future: more transactional services	Bring online services to mobile devices	Few focused applications with clear benefit	Arbitrary applications, less focus on efficiency

[a] City size according to population (medium 100,000–250,000; very large >500,000 inhabitants)
[b] Figures rounded for anonymity

financing. Similar to case A, the interviewee also cites regulatory challenges on the distribution of competences between different bodies, as well as data protection laws as significant constraints. As a result, despite being very active in the e-government area, the municipality has realized few mobile solutions, yet is planning to expand in this field, see Table 4.9.

Case C: An Efficiency-oriented Municipality

Case C is one of many German municipalities that must manage their resources in accordance with a budget-balancing concept.[8] IT operations have been entirely outsourced to a shared communal service provider. Similar to case A, the CIO and his staff, who are in charge of IT steering, are subordinate to the central office for personnel administration and organization. The municipality has established an internal idea management process, where employees from all kinds of departments may hand in ideas which are subsequently evaluated by the CIO and the central office.

The CIO considers m-government as an important topic. In course of cost savings and budget cuts, the administration is permanently forced to check for feasible alternatives. This mainly refers to the internal side (G2G), as such closed user groups mitigate the investment risk. Despite the growing popularity of internet connected devices, he sees less potential on the citizen side, as there seems to be only "a hand full of younger citizens" that would use m-government services and those are harder to influence as a target group.

On the governmental level, stakeholders are partly affine, partly averse, leaving it to IT to assure, that estimated costs-benefits are kept. A major concern on the technological level is, that a redundancy of m-government with traditional e-government channels, e.g. for mobile ticketing, will generally lead to higher costs. As an outcome, three out of four ideas for m-government improvements have successfully been implemented, two of which are internal applications. The fourth, a live internet transmission of town-hall meetings, has been dismissed due to an uncertain citizen demand (see Table 4.9).

Case D: An M-Government Laggard

Size and financial situation case D municipality are comparable to case A. Despite a considerable debt level, the municipality benefits from a relatively strong economic environment and corresponding tax incomes. Over the past years, the IT organization has undergone several changes. The current setup is comparably fragmented with more than half of the 250 IT employees being located in the main departmental areas. Central ICT is operating infrastructure, telecommunications and networks as well as the city website, and moreover generates business with external clients. There are two main

[8]The German Local Government Code provides that municipalities must manage their resources in accordance with a budget-balancing concept (Haushaltssicherungskonzept), in case expenditures exceed income in the municipal cameralistics. Such municipalities no longer have the freedom to decide whether certain voluntary tasks should be pursued.

governance bodies for IT decisions: IT steering meeting and IT planning group. The first comprises the IT heads of each IT department and meets 1-5 times a year to inform about new IT projects. Yet, a joint decision-making is only required only for large volume projects. IT planning group consists of two department managers from central IT and two from the office for personnel administration and organization. They jointly decide on technological and organizational guidelines of the municipality.

Central IT seems to have limited insight into user level drivers for m-government. According to the department head, there are hardly any requests to central ICT to offer any new services due to the decentralized structure. With the exception of the mobile city portal, all existing initiatives and realized applications stem from the solo efforts by departmental IT units, e.g. a parking payment application realized by the municipal traffic department. In some cases IT steering meeting was not sufficiently able to create alignment on such developments. This fact may even have induced operational problems, such as bandwidth problems and missing infrastructure support, when involving central ICT at a very late stage.

On an economic level, the objective of achieving cost savings is perceived strongly. However, central ICT as well as IT planning group largely fail to lever efficiency improvements due to a lack of empowerment and internal resistance, especially when processes and resources are concerned. The main strategy to overcome such resistance is seen in take an indirect way via the political level. For this reason, currently a strategic paper including e- and m-government elements is being elaborated. Once the political level adopts an idea, there may be a stronger momentum for renovation of the service landscape. However, the current outcome concerning mobile services is rather seen as the result of the departmental initiatives than of an overall strategy and efficiency goals (see Table 4.9).

Case comparison: Contingencies for M-Government Adoption

Regarding the service outcomes, we argue that municipality A has the strongest, cases B and C medium, and case D the lowest *adoption* of m-government services, which is in line with the quantitative findings provided in (Winkler and Ernst 2011). Furthermore, when exploring the *target groups* (citizens, business and government employees) we find that municipality A is focusing on all three of them, while B explicitly excludes citizens due to a perceived lack of demand from this user group. Municipality C is even more restrictive and relates m-government primarily to “closed” user groups, i.e. internal staff. For municipality D, no clear user focus could be recognized.

As a municipality context we explored size, economic profile and budgetary situation. Concerning *size* we selected two comparable cases each for mid-sized (B, C) and very large (A, D) cities. Based on the presented cases, we conclude that there is no support for a coercive correlation between the size of a municipality and the adoption of mobile services. In respect to the *financial situation* (economic profile and budgetary situation), we find more gradual differences between the four cases. Cases A and D exhibit a comparably good, case B a moderate-poor and case C a poor financial situation. We

Table 4.10: Contingencies for m-government adoption and target groups

		IT governance	
		Transformational	Non-transformational
Financial situation	Strong	Target groups: G2C, G2B, and G2G (Case A: Innovator)	Unfocused adoption (Case D: Laggard)
	Moderate	Target groups: G2B and G2G (Case B: IT experienced)	
	Poor	Target group: G2G (Case C: Efficiency-oriented)	

consider this fact to be an indicator of a relationship between the financial situation of a municipality and the outcomes of m-government adoption for cases A, B and C. However, for case D there seem to be further organizational contingencies.

Properties of the IT organization refer to horizontal distribution, governance mechanisms and sourcing degree. Regarding horizontal distribution and sourcing degree, we find considerable differences between cases A, B, C on the one hand, and case D on the other. We draw on IT governance theory and deduce that case D exhibits an unbalanced allocation of decisions rights between centralized and decentralized IT departments (Weill and Ross 2004a). Although municipality D has certain governance mechanisms in place, such as decision committees and an investment approval process, these practices apparently do not work effectively. Thus, decisions which enhance the efficient use of e- and m-government technology encounter large internal resistance. Moreover, unlike in cases A, B, C, the responsibilities for IT and organizational issues are organizationally separated, so that central ICT is not given sufficient *decision rights to promote changes of a transformational kind*, which amongst other effects, also inhibits m-government adoption. Concluding, we propose a new dimension for the *IT governance* property which will tell us, whether IT is equipped with such transformational decision rights or not (non-transformational). The resulting contingencies are summarized in Table 4.10.

4.2.7 Conclusion

This work used a multi method qualitative approach to explore the factors that influence public sector institutions in the adoption of mobile government services. We condensed these factors in a novel and empirically well grounded framework and demonstrated how to apply such framework in four case examples.

Findings and Contribution

Our findings suggest that process improvements and expected citizen benefits are among the strongest and most quoted drivers for m-government while the ability of the administration to change as well as technical integratability represent some of the strongest inhibitors. Furthermore, municipalities choose strategies such as inter-communal cooperation and increased citizen invovement to foster innovation diffusion and adequately address their target groups. The framework developed (Figure 4.7) may serve as an orientation for practitioners and academics who wish to better understand the set of factors that are critical in m-government adoption.

The framework is generally in line with the burgeoning literature on m-government. However, it throws a new light on the graduation between the factors, which have traditionally focused more on issues of privacy and security as well as accessibility. Privacy, security and the pertinent legislation still remains an important issue for local administrations, yet with less perceived impact on m-government adoption than literature suggests. The latter, accessibility, did not emerge as a major factor from our analysis. This reflects that the attention of local governments meanwhile has shifted from infrastructure to user-related issues so that municipalities today approach m-government with increased determination.

Examining the differences between those municipalities that lead the way and others that follow in m-government diffusion, the results of the case comparison provide support for the contingent influence of the contextual variables *financial situation* and *IT governance*. Building on these findings, we argue that municipalities with an economically challenging environment should first focus on internal m-government applications, while those with a comparably good financial situation may have the freedom to exploit the full range of citizen-, business- and emplyee-oriented m-government applications.

To underline our findings regarding the second contenxtual variable, we introduced the concept of *transformational IT governance*. This concept helps us to demonstrate that only those public sector agencies will succeed in transformational projects—such as m-government—that are able to effectively connect responsibilities for IT *and* organization so that organizational change can be managed and resistance be mitigated. We hereby enrich literature by a currently underrepresented, but important strategic aspect in e-government research and provide appropriate mid-range theory for m-government adoption on municipal level.

Limitations and Future Work

This work has some limitations which should be considered when interpreting the findings. First, due to the sample size of 12 municipalities, the theory developed may possess limited generalizability or leave out further important facets of m-government adoption. Second, the legal framework as well as the culture in Germany may be different from other countries which may limit the applicability to other national contexts. Finally, the voluntary participation in interviews may lead to a non-response bias of the interview data. However, these limitations are inherent to the qualitative approach, since for case study research a statistical sampling is generally not required (Merriam 1998). In a future work, we aim to validate the proposed theory in larger, confirmatory studies and investigate m-government adoption across different national contexts.

4.2.8 Summary

Using mobile services for e-government opens a new way of interaction between governments, citizens and businesses as well as within the public administration. However, governments face different drivers and inhibitors in their adoption behavior. In this chapter we investigated the question why public sector organizations differ in their adoption of mobile government innovations. Based on 12 in-depth interviews with municipal IT decision makers, we applied grounded theory and content analysis to derive a framework for drivers and inhibitors of m-government adoption. Further, we utilized this framework to analyze four cases in detail and identified the contextual differences in such municipalities. Finally, we isolate the effects in the way IT is governed and proposed the concept of *transformational IT governance* to explain some of the key differences in municipal m-government adoption.

4.3 Citizen Acceptance in Urban Sensing

4.3.1 Preamble

This chapter has been initially published and presented at the 20th European Conference on Information Systems, 2012 in Barcelona, Spain (see Winkler, Hirsch, Trouvilliez, and Günther 2012a).

4.3.2 Introduction

Urban sensing is receiving high attention as an emerging paradigm in pervasive computing (Cuff et al. 2008). This paradigm refers to understanding today's mobile devices—which are increasingly capable of capturing and transmitting image, audio, location and other data—as well as their users as sensor nodes of large information networks (Burke et al. 2006). Such sensing data can be useful for a broad range of applications of public interest (Johnson et al. 2007, p. 5), such as traffic and pollution monitoring (Kinkade and Verclas 2008, p. 52), environmental impact assessment (Mun et al. 2009), noise control (Maisonneuve et al. 2010). In particular, urban sensing may also enhance institutionalized e-government practices by the mobile channel and enable new ways of citizen participation.

Citizen participation is seen as an important building block for accountable and transparent urban governance and has been primarily studied under the aspect of public influence in policy making (Irvin and Stansbury 2004). However, ever since citizens have also been involved in public service delivery and helped to co-produce public value, for example when contributing or non-contributing to the regular activities of government officials (Whitaker 1980; Alford 2002). The enablement of such participation has been described as the highest stage in e-government evolution (Moon 2002). Emerging mobile information and communication technologies (ICT), such as urban sensing, allow for new possibilities of citizen participation and thus—given a wide acceptance—may help to reduce costs in both, public decision making and public service delivery (Kumar and Vragov 2009).

A number of recent studies have investigated the citizens' acceptance of e-government services (e.g., Carter and Bélanger 2005; Dimitrova and Chen 2006; Veit et al. 2010) as well as the user acceptance of mobile services (e.g., Wu and Wang 2005; Wang et al. 2006; Xu et al. 2009). However, few works have addressed the peculiarities at the intersecting domain of *mobile* e-government services, in particular urban sensing. Most notably, the link between the citizens' propensity to participate in urban affairs and the use of urban sensing is yet unclear (cp. Kuznetsov and Paulos 2010). A significant link would be indicative that offering participatory ICT tools is an effective means to enable more citizen participation (while insignificance would suggest that acceptance rather depends on other factors such as opportunistic motivations or enjoyment). Hence, we formulate our research questions: *a) How can we explain the citizens' acceptance of an urban sensing application* and *b) Is there a link between citizens' willingness to participate* *and the use of urban sensing applications?*[9] These questions are of crucial importance not only from a research perspective, but also for urban decision makers planning to implement participatory ICT tools.

In this chapter we investigate the user acceptance of a *mobile reporting service*, i.e. a participatory sensing application that enables citizens to report urban infrastructure issues such as potholes, waste and other defects. By the use of a mobile device, such report can be sent to the local authority directly on the spot, ideally tagged with a photo and according location coordinates. We chose this practical example of urban sensing as there are first mobile reporting applications (apps) available in the real-world. For instance, in Germany currently an increasing number of cities implement such service as an integral part of their mobile e-government offerings (Vitako 2011, p. 11). Moreover, independent private or semi-public service providers are pushing into this market and potentially cooperate with municipalities in offering web platforms that can be accessed by government officials as well as the citizens' mobile devices.[10]

As a theoretical framework for our study we draw on the seminal literature on technology acceptance (Fishbein and Ajzen 1975; Davis 1989; Venkatesh and Davis 2000; Venkatesh et al. 2003; Gefen et al. 2003) and combine our research model with appropriate constructs from e-government and mobile commerce research. To capture the unique characteristics of participatory urban sensing, we theoretically develop the new antecedent constructs *environmental awareness*, *willingness to participate* as well as *mobile literacy*. Empirical tests using data from 200 potential adopters support the validity and predictive power of all three constructs, which allows for interesting implications from a theoretical and a practitioners standpoint.

In the remainder of this chapter we will first review the theoretical foundations and develop our research model (4.3.3). In Section 4.3.4 we explain our methodology, the measurement instrument and sample characteristics. Section 4.3.5 analyzes and discusses the empirical results. Finally, Section 4.3.6 concludes by outlining the implications, limitations, and future work.

4.3.3 Theoretical Foundations and Model Development

Since urban sensing is a relatively new phenomenon, we root our research in the widely accepted technology acceptance model (TAM) by Davis (1989). TAM has been proven to provide robust predictions of intended use, even if a technology is not yet fully available to its prospective users (Sheppard et al. 1988; Davis et al. 1989). The overall research model is depicted in Figure 4.8.

[9] This work focuses on the *intention* to use urban sensing. Although there are numerous factors that possibly influence individuals in translating their intentions into behavior (Morwitz 1997), the intention to use is still inherently linked and strongly correlated with *actual use* (Davis et al. 1989; Sheppard et al. 1988)

[10] Examples are amongst others City Sourced (www.citysourced.com) in US, FixMyStreet (www.fixmystreet.com) in UK, as well as Mark-a-Spot (www.markaspot.de) and WDW-Anliegen (www.werdenktwas.de) in Germany.

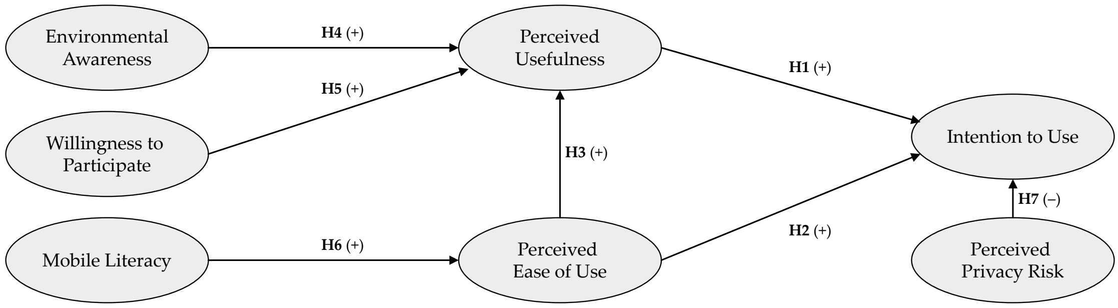


Figure 4.8: Research Model

Technology Acceptance in Urban Sensing

Urban sensing can be regarded as a class of information and communication technologies that are embedded in a whole system of actors and artifacts. Such system would typically consist of the citizens, their mobile devices running the urban sensing application, a central server processing messages from the citizens, and a website presenting according information to citizens and recipients of the urban administration. The citizen's individual decision of adopting (i.e., installing the application on his or her mobile device) and using such technology (i.e., sending reports when encountering an infrastructure issue) can be explained by drawing on TAM.

TAM has been developed by Davis (1989) based on the theory reasoned action (Fishbein and Ajzen 1975, TRA,) and was found to be a robust theory for explaining technology adoption on user level. With regard to technology adoption, TRA essentially states that beliefs about information technology influence the user's attitudes, which subsequently lead to behavioral intentions and actual technology usage. According to TAM, beliefs about information technology can be attributed to the two dimensions perceived usefulness (PU) and perceived ease of use (PE). TAM provides that both constructs may be influenced by further external variables that capture specific beliefs about the respective technology (Davis 1989). Numerous adaptations and extensions of TAM have been proposed (see Legris et al. 2003; Yousafzai et al. 2007, for overviews). Particularly the user's attitudes and their mediating influence have been removed from the model in a later revision (Venkatesh and Davis 2000).

Despite its origin in organizational contexts—where the users of a technology are typically employees—TAM has also been transferred to the adoption of diverse non work-related technologies (e.g., Gefen et al. 2003). In such voluntary settings, the influence exerted by subjective norms has been found to be less significant (Venkatesh and Davis 2000; Venkatesh et al. 2003). The scenario of an urban sensing application offered by a local municipality represents such a voluntary setting. It can be attributed to the intersection of mobile commerce and e-government, an emerging field that has also been termed as mobile government (Kushchu and Kuscu 2003). We will draw on the literature in both intersecting fields to develop our research model.

Intention to Use, Usefulness and Ease of Use in Urban Sensing

Since urban sensing is a rather new phenomenon, we focus on the intention to use (IU) as the dependent variable of this research. According to TRA, behavioral intention can be interpreted as the *subjective probability that a person will perform a specific behaviour*, e.g., *to adopt an urban sensing application* (Fishbein and Ajzen 1975). Although individuals tend to overestimate their intended use, it has been shown that this variable strongly correlates with the later adoption and use of a system (Sheppard et al. 1988; Davis et al. 1989).

Perceived usefulness (PU) can generally be defined as *a measure of the individual's subjective assessment of the utility of an information technology in a specific task-related context* (Gefen et al. 2003). In case of a citizen and the voluntary use of urban sensing, perceived usefulness may refer to the individual task-related context as well as to the broader collective utility of an urban context. Individual utility relates to convenience, efficiency and effectiveness when reporting issues directly on the spot via a mobile device, compared to the traditional ways of reporting (i.e., by phone calls or emails to the urban administration). Consequently, collective utility is generated if the collective usage leads to according effects on the overall quality of living, e.g. through a cleaner environment and a higher responsiveness of the urban administration. That is, we are not restricting perceived usefulness to an individual performance expectancy of the citizen (cp. Venkatesh et al. 2003), but include the idea of collective usefulness and public value within this construct (Alford 2002, p. 33). Some authors argue that inclusion of such domain-specific characteristics in PU can provide a better understandability of the overall model (Yousafzai et al. 2007, p. 300). In line with TAM we pose

H1: *Perceived usefulness (PU) will positively affect the intention to use (IU) urban sensing.*

According to Davis (1989), perceived ease of use (PE) is defined as *the degree to which a person believes that using a particular system would be free from effort.* Ease of use is also one of the central goals in human computer interaction and usability engineering (e.g., Nielsen 1994). Usability can be achieved by creating systems that are easy to understand, easy to remember, efficient to use, and subjectively pleasing (Nielsen 1994, p. 26). Regarding a mobile application for urban sensing, this may refer to user interface design as well as the usability of the mobile device itself. It has been shown that users largely base their usability assessment on general beliefs and previous experience, especially for technologies that are new to them (Venkatesh et al. 2003). Therefore system-independent factors are at least equally important to objective usability criteria for the ease of use perception. According to TAM, perceived ease of use not only influences the intention to use (IU), but also perceived usefulness (PU). That is, the easier an urban sensing application is to use, the more useful it can be. We pose:

H2: *Perceived ease of use (PE) will positively affect the intention to use (IU) urban sensing.*

H3: *Perceived ease of use (PE) will positively affect the perceived usefulness (PU) of* *urban sensing.*

Antecedents of Perceived Usefulness in Urban Sensing

TAM provides that the core constructs (PE, PU) may be explained by external variables which are more specific to the technology (Davis 1989). Urban sensing applications can be regarded as large information networks (Burke et al. 2006). Social network theory provides that the behavior of each of the nodes within this network can be characterized by opportunistic or altruistic behavior (Hui et al. 2009). We build on this dichotomy and propose two antecedents for perceived usefulness: environmental awareness (EA) and willingness to participate (WP).

Environmental awareness (EA) refers to the opportunistic motivation for using urban sensing. The fundamental idea of urban sensing is to capture and counteract environmental issues such as traffic, noise, or infrastructure defects (Burke et al. 2006). Yet, citizens presumably differ in their perception of the urban environment. Therefore we define environmental awareness (EA) as *the degree to which an individual is concerned about the physical state of his/her direct urban environment.* Those citizens who are highly aware about their environment will possibly find an urban sensing application more useful, because they have an inherent interest that irregular environmental issues be corrected. In a wider sense this construct can also be related to performance expectancy in an organizational context (Venkatesh et al. 2003; Gefen et al. 2003). That is, the urban sensing application helps environmental-aware citizens to better perform their context-related task of reporting an issue. We pose

H4: *Environmental awareness (EA) will positively affect perceived usefulness (PU) of urban sensing.*

Willingness to participate (WP) is the central construct of this research and captures a more altruistic motivation for using urban sensing. Alford (2002) identifies willingness as the principal reason for citizens to participate and co-produce public value. Based on this, we define the willingness to participate as *the degree to which an individual wants to participate in public affairs and urban decision making* (no matter by which means). In Political Science, participation is regarded as one of the core aspect of civic engagement for society (Dimitrova and Chen 2006, p. 177). Yet, in the Information Systems field, few works have explicitly considered this construct to explain e-government adoption—a fact that may as well call for more interdisciplinary approaches, as some authors claim (Carter 2006, p. 9). Carter (2006) explains the adoption of Internet voting through *political motivations* such as political interest, efficacy and mobilization, besides other technological and demographic factors. Dimitrova and Chen (2006) emphasize that *civic mindness* is one of four major factors that influence the intention to use e-government services. Veit et al. (2010) add *political motivation* as new construct to a TAM model for e-participation and social media tools. Their findings suggest that political motivation does not have a moderating influence on the relationship between EU and IU, but significantly influences adoption of e-participation tools as an antecedent of IU. However, these works mostly refer to (a) stationary Internet tools and (b) to the policy making level. We assume that (a) the use of mobile Internet tools (b) on the service delivery level is also likely to be an extension of the citizens' political involvement via traditional channels (cp. Whitaker 1980). Therefore we pose

H5: *Willingness to participate (WP) will positively affect perceived usefulness (PU) of urban sensing.*

Mobile Literacy and Perceived Privacy Risks in Urban Sensing

Since today's mobile devices are becoming increasingly 'smart', i.e. powerful in functionality and connectivity, they set new requirements regarding basic user skills and trust (cp. Johnson et al. 2007). We include mobile literacy of the user (ML) and the perceived privacy risks towards mobile service providers (PR) as two further constructs of our research model.

Other authors have suggested that the concept of literacy could be an influential underlying mechanism that is currently underrepresented in technology adoption research (Venkatesh et al. 2003, p. 469). Based on the concept of computer literacy (Winter et al. 1997) we define mobile literacy (ML) as *the perceived ability to use 'smart' mobile devices efficiently and effectively.* This conceptualization can ultimately be regarded as a special form of computer self-efficacy (Davis 1989, p. 321). Social cognitive theory provides that users strongly anchor their ease of use perceptions about an information system to their computer self-efficacy, i.e. their perceived ability to use this system (Venkatesh et al. 2003, p. 455). Applied to the context of mobile technology, self-efficacy may refer to perceived skills for browsing the mobile Internet, installing a mobile application and handling touch-screens. Such general beliefs can be derived from own experience (i.e., the use of mobile applications other than urban sensing) or from observations of others (Venkatesh and Davis 2000, p. 192). Accordingly we pose:

H6: *Mobile literacy (ML) will positively affect the perceived ease of use (PE) of urban sensing.*

Trust and trustworthiness play an important role in user acceptance of both, e-commerce and e-government systems (Gefen et al. 2003; Carter and Bélanger 2005). Users assess different types of risks when engaging in online activities or transactions (Wu and Wang 2005, p. 722). This effect becomes even more prevalent with the use of mobile services, where location and personalization information may unintentionally be disclosed to a third party (Xu et al. 2009). Inverting the definition for perceived credibility from Wang et al. (2006), we define perceived privacy risk (PR) as *the extent to which a person believes that using a mobile service will not be free from privacy threats.* Literature suggests that individuals perform a 'privacy calculus' in balancing the risks with the outcome they receive as a return for providing personal information (Xu et al. 2009; Krasnova and Veltri 2010)—in case of urban sensing for example location, photo, recording and potentially identifying contact information (Johnson et al. 2007). Therefore, constructs like perceived risk are commonly hypothesized to directly affect the intention to use (Gefen et al. 2003; Wu and Wang 2005; Wang et al. 2006, e.g., in). Accordingly we pose

H7: *Perceived privacy risk (PR) will negatively affect the intention to use (IU) urban sensing.*

4.3.4 Methodology

A field survey was conducted to test the proposed research model. Since urban sensing represents a class of information systems rather than a concrete application, we chose a *mobile reporting service*, i.e. an urban sensing application to report urban infrastructure issue (e.g., potholes, waste, and other defects) as a concrete scenario for our survey. In the following we describe our approach to develop the measurement instrument and to acquire a sample of citizen respondents.

Instrument Development

Model constructs were derived based on existing literature and operationalized on 5-point Likert scales. New items were developed where necessary, especially for the proposed constructs environmental awareness (EA), willingness to participate (WP) and mobile literacy (ML). Also, established constructs such as perceived usefulness (PU) were complemented by appropriate new items in order to adapt them to the specific context of a mobile reporting service. We targeted at 5 items for each of these new or adapted constructs, 4 items for the more established variables, and 3 for intention to use.

Based on our conceptualization as perceived attributes, all constructs are modelled as reflective latent variables. That means that the causal direction is assumed to point from the construct to the item (i.e., the item *reflects* the true value of the latent variable). In order to allow for later consistency and response bias checks, we formulated one reverse-coded item for each of the constructs (except for IU). The final questionnaire was pretested with fellow researchers as well as potential respondents and revised in a number of iterations. The resulting measurement instrument and originating literature is presented in Table 4.11. The online survey in German language is presented in Appendix 2

Sample Characteristics

The survey was administered online and distributed across the personal networks of the authors. Apart from the model items, it contained a brief introduction to the topic (including a series of images to explain the functionality of a mobile reporting service), questions regarding mobile phone usage and demographic data, as well as the possibility to leave an email address for receiving the later survey results. No further incentives for participation were offered. Special attention was paid to the demographic distribution of the recipients in order to achieve a balanced panel of different occupational and age groups (i.e., not only students).

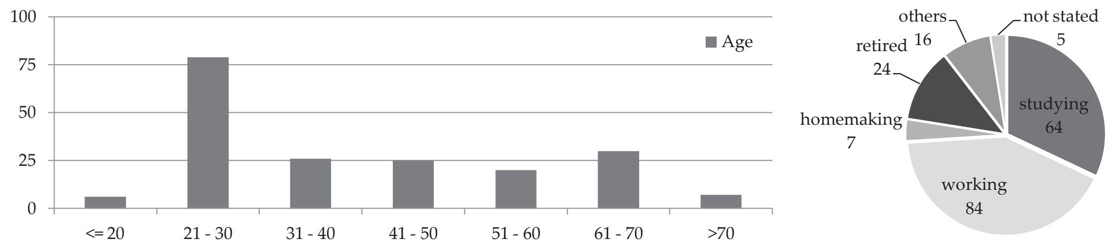


Figure 4.9: Respondent age and occupation (n=200)

The response period was three weeks during July 2011. Out of 320 participants who opened the survey, 215 completed all relevant survey questions. Data cleaning was performed carefully to filter for unrealistic or inaccurate answers. Apart from the reverse items, we had included two redundant questions (Do you use a smartphone? no/ yes; Are you planning to use a smartphone? I already use/ I am planning to use/ I might be planning to use/ etc.). 15 respondents did not answer these questions consistently and thus were rigorously removed from the sample. (Note that the term 'smartphone' had been defined earlier in the survey, however, using a smartphone was not a prerequisite to participate in the survey.) The resulting distribution of survey respondents' age and occupational status (53% female, 45% male, 2% not stated; 45% users of smartphones, 55% non-users) is depicted in Figure 4.9.

4.3.5 Model Analysis and Discussion

We employ partial least squares (PLS) to assess the psychometric adequacy of the measurement model and test the hypothesized structural model. The choice of PLS is motivated by the rather explorative character of this study including three new developed constructs. As Reinartz et al. (2009, p. 341) note, the variance-based PLS is less likely to overestimate relationships between constructs that have potentially not been well operationalized, compared to covariance-based approaches to structural equations modeling such as LISREL. Calculations were performed using the software tools SPSS version 17.0 and SmartPLS version 2.0.M3 (Ringle et al. 2005).

Measurement Model and Common-Method Bias Assessment

As the first step in the model assessment we evaluate the indicator reliability. Indicator loadings are listed in Table 4.11. Values should be above 0.7 so that the reflective latent variable explains at least 0.5 ($\approx 0.7^2$) of the variance of each indicator (Chin 1998b). This is not the case at least for some of the items adapted from literature (PR3 and PR4). We ascribe the weak loading of PR3 to a confounding phrasing which omits the words "I think", thus asking for an agreement to an act that is actually legally prohibited (i.e., I will typically strongly disagree that "a mobile service" can/ ought to "divulge my data", while I may still see high privacy risks in using it). Consequently, item PR3 is removed

Table 4.11: Measurement instrument, descriptive statistics and reliabilites

Item	**Text**	**Load**	**Source**
IU1	I can imagine to use the mobile reporting service	0.90***	Davis 1989;
IU2	I think about using the mobile reporting service	0.83***	Venkatesh et al.
IU3	I intend to use the mobile reporting service (MRS)	0.91***	2003
PU1	A MRS would save time for reporting infrastructure issues	0.86***	Venkatesh et al.
PU2	A MRS allows one to report problems on the spot	0.82***	2003; Gefen
PU3	A MRS service allows people to report more infrastructure issues	0.83***	et al. 2003;
PU4	Overall, I find it useful to have a MRS for my city	0.93***	Alford 2002;
PU5^r	I think a mobile reporting service would be ineffective for my city	0.75***	self-developed
PE1	The interaction with this service would be easy for me to understand	0.81***	Davis 1989;
PE2	Using a mobile reporting service would not be much effort for me	0.90***	Venkatesh et al.
PE3	Overall, I think that a mobile reporting service would be easy to use	0.99***	2003
PE4^r	I find it cumbersome to use a mobile reporting service	0.84***	
EA1	I am concerned about infrastructure issues in my environment	0.65***	Self-developed;
EA2	I want any infrastructure issues in my environment to be removed	0.85***	Burke et al.
EA3	I am interested in keeping my neighborhood clean	0.75***	2006; Gefen
EA4	I appreciate if the properties in my city are clean and tidy	0.68***	et al. 2003
EA5^r	I don't care about infrastructure issues in my environment	0.79***	
WP1	I like to have an influence in my city	0.73***	Self-developed;
WP2	I like to call the attention of my city on certain grievances	0.85***	Dimitrova and
WP3	I like to take part in decision-making in my city	0.89***	Chen 2006;
WP4	I communicate issues to the municipality that I find important	0.76***	Carter 2006; Veit
WP5^r	I don't need any influence in my city	0.68***	et al. 2010
ML1	For me it is easy to use internet services on a mobile phone	0.94***	Self-developed;
ML2	I am well versed in using internet services on a mobile phone	0.90***	Venkatesh et al.
ML3	I could often use internet services on a mobile phone	0.84***	2003; Winter
ML4^r	I need help with using internet services on a mobile phone	0.69***	et al. 1997
PR1	I think that service providers can abuse user data	0.81**; 0.87***	Wang
PR2	I am reluctant to provide personal information to a mobile service	0.83**; 0.87***	et al.
PR3	A mobile service can divulge my personal data	0.12 ; —	2006
PR4^r	I think that one can trust the providers of mobile internet services	0.39 ; 0.54*	

^{r}reverse-coded item; significance levels: $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$

from the analysis.

A recalculation in PLS leads to a significant loading of 0.54 in PR4 (p<0.1). Also, we note that reverse-coded items largely have lower loadings than their forward-coded counterparts. However, we abstain from removing further items from the measurement model, since all criteria for convergent validity (especially for PR) yield in acceptable values. (For robustness, we also calculated models with strict removal of items PR4, EA1, WP5, and ML4 which did neither change the principal outcomes of the hypotheses tests, nor the relative strengths between the paths of the structural model.) Convergent validity criteria of this revised model are above the recommended thresholds for Cronbachs alpha (Alpha>0.7), composite reliability (CR>0.6) and average variance extracted (AVE>0.5), see Table 2. This indicates that the remaining items sufficiently reflect the properties of their respective constructs (Chin 1998b).

Discriminant validity was assessed by three types of analyses: (1) an evaluation of cross-loadings (Chin 1998b, p. 321), (2) the Fornell-Larcker (1981, p. 46) criterion as well as (3) an exploratory factor analysis (EFA). (1) The mean of absolute cross-loadings is 0.20 with a maximum at 0.59 (ML1 on PE), thus below the variance-explaining value of

Table 4.12: Convergent and discriminant validity criteria

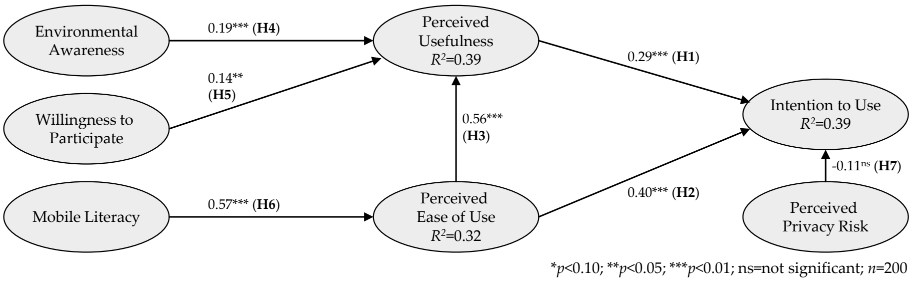
	Convergent validity			Discriminant validity (correlations and $\sqrt{AVE}$)						
Construct	Alpha	CR	AVE	IU	PU	PE	EA	WP	ML	PR
IU	0.86	0.91	0.78	**0.88**						
PU	0.89	0.92	0.70	0.52	**0.83**					
PE	0.89	0.92	0.75	0.56	0.56	**0.87**				
EA	0.82	0.86	0.55	0.42	0.30	0.09	**0.74**			
WP	0.83	0.88	0.59	0.28	0.17	-0.07	0.40	**0.77**		
ML	0.86	0.90	0.70	0.29	0.25	0.57	-0.09	-0.06	**0.84**	
PR (incl. PR3)	0.78 (0.76)	0.81 (0.64)	0.59 (0.37)	-0.13	-0.07	0.00	-0.08	-0.08	-0.16	**0.77**

0.7 for direct factor loadings. (2) The Fornell-Larcker criterion, which states that square root of AVE (represented as diagonal elements) should exceed the off-diagonal elements in the construct correlation matrix, is also fulfilled, see Table 4.12. (3) The results of an EFA (Kaiser-Meyer-Olkin criterion=0.84; eigenvalues>1) support discriminant validity, since the principal components analysis produces seven factors that can be clearly distinguished after varimax rotation. Overall, the assessment of convergent and discriminant validity support the psychometric adequacy of the revised measurement model.

As for all self-reported data, there is a threat for a common method bias (CMB) due to the subjects' motif to give socially desirable and cognitively consistent answers (Podsakoff and Organ 1986). We assessed CMB by a Harman's one-factor test as well as a latent method factor approach (Liang et al. 2007). The first factor from the EFA accounts for 0.23 of the total variance (and predominantly loads on the indicators of PU), thus contradicting the existence of a single dominant factor according to Harman. Following the procedure described by Liang et al. (2007, p. 85), we included a common method factor in the PLS model comprising all model indicators, and calculated the influence on each principal indicator by its substantive construct and by the method factor. The analysis shows that the average substantively explained variance is 0.69 while the average method-based variance is 0.012 (ratio 44:1). Additionally, after bootstrapping all substantive loadings remain significant ($p<0.01$) while most path coefficients from method factor are not significant. Altogether these results indicate the method bias is not a serious concern for this study.

Structural Model Assessment and Discussion

The results of the structural model assessment are depicted in Figure 4.10. Statistic significance of the parameter estimates (i.e., path coefficients in Figure 4.10, as well as factor loadings in Table 4.11) was assessed through T-tests based on a bootstrapping procedure using 1,000 resamples. For the purpose of hypothesis testing, the path coefficients (c) and explained variances (R^2) can be interpreted similar to parameters in a simple regression.



Hypothesis tests	
H1	Supported
H2	Supported
H3	Supported
H4	Supported
H5	Supported
H6	Supported
H7	Not sup.

Figure 4.10: Structural model results

H1, H1: Perceived usefulness (PU), perceived ease of use (PE) and (with certain limitations) perceived privacy risks (PR) jointly explain R^2_{IU}=0.39 of the variance in the intention to use a mobile reporting service. This level of determination is largely consistent and fully in the range of previous TAM studies (Legris et al. 2003, p. 200; Venkatesh et al. 2003, p. 441). Yet, in our model the influence of perceived usefulness ($c_{\mathrm{P}_U\rightarrow \mathrm{I}_U}$=0.29***) is clearly weaker than the influence of perceived ease of use ($c_{\mathrm{P}_E\rightarrow \mathrm{I}_U}$=0.40***). This is remarkable since most TAM studies suggest that even in voluntary settings the influence of PU outweights PE (Venkatesh et al. 2003, p. 441; Yousafzai et al. 2007, p. 299). We attribute this difference to the newness of the technology and a lack of concrete user experiences with urban sensing. Several authors have demonstrated that PE is relatively more important in student samples and laboratory settings (Yousafzai et al. 2007, p. 299), while it becomes non-significant with increasing experience of the users (Davis et al. 1989; Venkatesh et al. 2003, p. 433).

H3: In line with previous research, the results also demonstrate a strong significant relationship between ease of use and usefulness ($c_{\mathrm{P}_E\rightarrow \mathrm{P}_U}$=0.56***). The explained variance in perceived usefulness R^2_{PU}=0.39 reduces to 0.10 when removing this link from the model, which shows the strong influence of PE on PU (effect size $f^2_{PE\rightarrow PU}$=0.48). Thus, users not only anchor the intention to use, but also their perceived usefulness in their ease-of-use perceptions of new urban sensing technologies (and similar experiences, as we will see further below).

H4, H5: Regarding the antecedents of perceived usefulness (PU), we find that environmental awareness ($c_{\mathrm{E}_A\rightarrow \mathrm{P}_U}$=0.19***) and willingness to participate ($c_{\mathrm{W}_P\rightarrow \mathrm{P}_U}$= 0.14**) are both significant predictors in urban sensing adoption. However, the path strengths indicate that—in the given case of a mobile reporting service—opportunistic goals connected to environmental awareness (i.e., wanting infrastructure issues to be corrected) seem to be more important than the altruistic motivation of political participation (i.e., to have an influence in public affairs and urban decision making). This is not surprising inasmuch as a reporting service (and the promise that occurring issues will be taken care of) largely targets the level of service delivery. Nevertheless, other urban sensing applications (e.g., for long-term traffic monitoring or noise controlling), may gather high-level information that targets more at the decision-making level. This underlines the importance of considering willingness to participate (WP) as a dedicated construct within this adoption model of urban sensing.

H6: Mobile literacy is found to be a strong predictor of perceived ease of use ($c_{\mathrm{M}_L \rightarrow \mathrm{P}_E}$= 0.57^{***}). This is in line with the concept of computer self-efficacy derived from social cognitive theory (Venkatesh et al. 2003) and confirms that users largely anchor their ease of use perception in previous experience or observations of others. The strong path coefficient demonstrates that we were able to provide a well-performing operationalization of this construct specifically for the context of mobile technology.

H7: Perceived privacy risks ($c_{\mathrm{P}_R \rightarrow \mathrm{I}_U}$= -0.11^{ns}) are negatively correlated to intention to use, however, do not significantly affect this construct (effect size $f^2_{PR \rightarrow IU}$=0.02). Statistical reasons for this non-significant path have been ruled out during the assessment of item reliability (see Section 4.1). Thus, we aim to provide a context-related explanation for this—at first view—counter-intuitive results: Perceived privacy risks have been conceptualized as *the extent to which a person believes that a mobile service will not be free from privacy threats.* Thus, similar to mobile literacy, this construct referred to the *general* perceptions about (public or private) mobile services. In this survey, we described the concrete scenario of a *public* mobile reporting service, i.e. a sensing application that is offered by a local authority. Thus, although the citizen's reporting information may pass a number of third parties (e.g., network providers, platform providers) the recipient remains a public entity. Factor analyzes performed by Carter and Bélanger (2005, p 10) indicate that citizen do *not* clearly distinguish between trust of the Internet and trust of the government when using e-government tools. We argue, that a generally more positive trust attitude towards the local government influences in this relationship, so that privacy risks are not a severe issue for this type of sensing application.

4.3.6 Conclusion

In this work we investigated the citizens' acceptance of urban sensing applications, based on the example of a mobile reporting service. For this purpose, we concretized a technology acceptance model (TAM) to our specific context and extended it by the three external variables *environmental awareness*, *willingness to participate*, and *mobile literacy.* Empirical tests employing the partial least squares method (PLS) and data from 200 potential adopters support the psychometric validity and significance of all three constructs. Most prominently, mobile literacy emerges as an important anchor not only for the ease of use perception, but ultimately also for perceived usefulness and intention to use novel mobile services such as urban sensing.

Regarding our focal question, we contend that indeed there seems to be a significant link between the citizens' willingness to participate in public affairs and the use of urban sensing. However, this link is slightly outweighed by the individual's environmental awareness, suggesting that opportunistic and utilitarian motivations will still prevail in the use of urban sensing. Besides these results, we were unable to replicate the findings of previous studies stating that trust, more specifically *perceived privacy risk*, plays an important role in the adoption of mobile services. We attribute this finding to the given scenario of a *municipal* reporting service and conclude that privacy risks seem not to be a significant barrier to adoption of *public* mobile offerings.

These findings provide important implications for practice, foremost for public authorities that are faced with decisions on their mobile e-government strategy. First, the significant link between willingness to participate and perceived usefulness suggests that mobile applications such as urban sensing are not "just toys", but one out of a range of possible tools to enhance citizen participation (cp. Kumar and Vragov 2009). To some extent, this challenges the opinion still prevailing in many in urban authorities that mobile government is just something for "a hand full of younger citizens" (Winkler et al. 2011b, p. 10). Second, concerns regarding privacy and data security, which are widely discussed in public sector and often act as a barrier already on decision-making level (Winkler et al. 2011b, p. 2), can be largely dispelled based on the given findings. For example, in case a specific municipal mobile service requires entering the user's contact details to ensure proper functionality, this is *not* likely to inhibit the citizens' adoption. Ultimately, attention in the development of mobile government offerings should rather be drawn on the ease of use of these applications, in order to match usability criteria of comparable (commercial) mobile services and thus reach a broad user base.

This work also aims to make a contribution to the research community. Originating from the field of pervasive computing, the comparably young stream of urban sensing has largely been driven by technical considerations and design-oriented works. To the knowledge of the authors, this is one of the first works to investigate user acceptance in urban sensing. We contend that behavioral research on end-user level can complement urban sensing research to allow for a better transition to practice. We concretized the robust and widely applied technology acceptance model (TAM) to the context of urban sensing and demonstrated its use in a specific mobile government scenario. Other researchers may use this model in different urban sensing scenarios and thus facilitate a better understanding of user characteristics and their motivations in this emerging field.

A few limitations of this study merit consideration, foremost related to sample characteristics and generalizability. Although representativeness to a basic population is not a general requirement for correlation-based survey approaches, and variances from voluntary participation were ruled out by common-method bias tests, we still acknowledge that our sample exhibits a notable emphasis on students between 21-30 years. Further, technology acceptance, especially privacy concerns, may be subject to cultural influences. Most of the survey responses were acquired in Germany, a national context with comparably great sensitivity to privacy issues (Krasnova and Veltri 2010). However, the results may still differ in other national contexts, for example due to greater distrust in public governments (Carter and Bélanger 2005, p. 9). Finally, since the focus of this work was on theory development and instrument validation, the model does not explicitly take into account potentially moderating variables such as age, experience, and gender (Venkatesh et al. 2003). In a future work, we hope to conduct a larger study in different national contexts and evaluate the moderating influence of demographic parameters on the adoption of further (public and private) urban sensing applications.

4.3.7 Summary

Urban sensing describes the use of today's mobile devices to collectively gather information about environmental issues of public interest. Such information and communication technology tools can enhance current e-government practices by enabling citizens to actively participate in urban decision making and service delivery. Yet, it is widely unclear whether there is a link between the citizens' propensity to participate and the use of urban sensing technology. In this chapter we drew on the seminal adoption literature to propose a model for the acceptance of a mobile reporting service, i.e. a sensing tool for reporting urban infrastructure issues to a municipality. The model explains perceived usefulness of urban sensing by the citizen's degree of environmental awareness and his/her willingness to participate in public affairs. Furthermore, we conceptualized mobile literacy as an important antecedent of perceived ease of use. Empirical tests using data from 200 potential service adopters support these ideas. The findings also suggest that for mobile e-government offerings, perceived privacy risks are not a significant barrier to adoption. We outlined important implications for theory and practice.

4.4 Municipal Benefits of Urban Sensing

4.4.1 Preamble

The work presented in this chapter emanates from a joint cooperation with the State Capital of Saarbrücken. We gratefully acknowledge the permission of the Saarbrücken municipal administration and the support of the involved persons for conducting and publishing this research. At the time of publishing this dissertation, this chapter has been accepted for the Journal for Applied Electronic Commerce Research (JTAER) and will appear in a special issue on Smart Applications for Smart Cities: New Approaches to Innovation (see Winkler, Ziekow, and Weinberg 2012b).

4.4.2 Introduction

Local governments increasingly understand citizen participation as an important building block of modern public administration. New public management poses that through participation, citizens and public agencies can co-create public value which also strengthens democratic authorization, legitimacy, and trust (Moore 1995). While participation has been primarily studied under the aspect of influence in public policy and decision making, citizens have ever since also participated in public service delivery and thus co-produced public value in the day to day routines of public administrations (Alford 2002; Whitaker 1980).

Information and communication technology (ICT) plays an important role not only to enable participation, but also to dramatically reduce efforts and increase the speed of interaction compared to traditional ways of citizen involvement (Kumar and Sinha 2007). Today, the pervasiveness of mobile internet-connected devices, such as smartphones and tablet PCs, makes it possible to gather opinions and environmental data from citizens directly on the spot (Cuff et al. 2008). Currently, an expanding research community is developing participatory sensing systems for a broad range of applications, such as environmental impact assessment (Mun et al. 2009), air quality monitoring (Aoki et al. 2008), traffic mitigation (Hull et al. 2006), and noise control (Maisonneuve et al. 2010). However, most of these initiatives are designed in a grassroots fashion as individual projects, separate from the realm of integrated E-Government initiatives (Burke et al. 2006). One reason behind this may be that public institutions are generally thought of as too slow to keep pace with the rapid developments in urban sensing and therefore place more emphasis on mobile applications for equipping internal staff (Kamal 2006). Some *laggard* municipalities may even have the conception that mobile citizen participation is more a *nice-to-have* than an absolute necessity to sustain the efficiency of public service delivery (Winkler and Ernst 2011; Winkler et al. 2011b).

This study argues in contra, that it is worth to bridge the gap between participatory sensing approaches and municipal E-Government strategies to embrace data from citizens in urban management. We show that not only soft, but also hard quantifiable benefits can be achieved for the municipality related to information quality and cost. As a scenario, we consider a mobile reporting service, i.e. a participatory sensing application where citizens can report urban infrastructure issues, such as potholes, waste and other defects to the local authority, ideally tagged with a photo and according location coordinates. Such services are becoming increasingly popular as part of the integrated mobile offerings of a number of cities (e.g., a prominent example is NYC311[11]).

We take an action design research perspective and develop a simulation model as an organization-dominant artifact (Sein et al. 2011) that facilitates decision-making and fosters the acceptance of such services among municipal stakeholders. The simulation estimates the citizen adoption and benefits from a municipal perspective in terms of issue awareness and required street inspections. The model itself and its usefulness in decision-making contexts are demonstrated by the case of the State Capital of Saarbrücken, a large German municipality. As currently various possibilities of urban sensing emerge, the result of our work can aid local governments and service operators equally to engage in public-private partnerships and jointly foster more urban citizen participation.

In the remainder of this chapter we will first review related work regarding urban sensing and the simulation method. Then, in Section 4.4.4 we describe the methodological approach of this research. Section 4.4.5 presents the proposed simulation model and its underlying assumptions. Section 4.4.6 describes the results of the case validation separated into the stages of process analysis, model instantiation, scenario simulation, qualitative analysis and parameter estimation. Finally, Section 4.4.7 concludes by evaluating our methodology and outlining the contributions, limitations and future work.

4.4.3 Related Work

This section explains the underlying concepts of this research from a thematic and a methodological perspective. This work can be thematically attributed to the intersecting field of urban sensing and E-Government research. Methodologically we employ System Dynamics (SD) as a method to design our simulation model.

Participatory Urban Sensing

Urban sensing describes the leap in pervasive computing from embedded networked sensing in the laboratory to the real-world environment, e.g. in form of mobile phones (Cuff et al. 2008). As these *smart* mobile devices are increasingly capable of capturing, classifying and transmitting image, acoustic, location, acceleration and other data, they can be perceived as sensor nodes and location-aware data collection instruments (Burke et al. 2006). Thus, urban sensing and its numerous applications that emerge can be seen as a first manifestation of the vision of ubiquitous computing (Weiser 1991).

Depending on the role of the user in urban sensing, two fundamental interaction patterns are differentiated. *Participatory* sensing refers to applications where conscious human interaction is required to decide which data is shared, while in *opportunistic*

[11] Non-emergency information service New York City, USA (www.nyc.gov/apps/311/about.htm)

sensing the device acts autonomously and acquires data whenever its state matches defined context requirements (Lane et al. 2008). The term participatory sensing itself has been coined by Burke et al. (2006) and was primarily motivated by the idea to enable grassroots campaigns that gather data on issues of public interest.

Over the last few years, some municipalities have embarked on the concepts of participatory sensing. Regarding the given scenario, an example for a participatory application is the service NYC311 from New York City[11] where users can report various local problems via their mobile device. In contrast, other applications (e.g., Street Bump piloted in Boston[12]) aim to report potholes and other street defects based on location and acceleration profiles of a driving vehicle, thus taking an opportunistic approach to sensing. In addition, there are a number of research projects that make tremendous technical advances for supporting these and further application scenarios.

An example provided by a team at University of California Los Angeles[13] is PEIR , the personal environmental impact report, a system that uses GPS data from mobile phones and classification algorithms to determine the users' mode of transportation and travel routes. From this information the service deducts information on the environmental impact, e.g. the carbon footprint and pollution impact, and gives the user feedback (Mun et al. 2009). The project Common Sense at Intel Labs Berkeley[14] focuses on the development of mobile sensors for collecting pollution and air quality data (such as carbon monoxide, ozone, nitrous gases, temperature and humidity) as well as the visualization of data in sample applications. The device is designed such that it can be easily carried along by a person and transmits environmental data to via in-build GPRS or through the user's mobile phone (Aoki et al. 2008).

Further examples are the CarTel projects at Massachusetts Institute of Technology[15], which address road transportation issues including traffic mitigation and pothole detection. The traffic mitigation application uses location data from mobile phones as input to algorithms for traffic analysis, prediction, and according traffic-routing suggestions. The pothole detection uses dedicated sensing devices mounted on vehicles, which measure 3-axis acceleration and location data (Hull et al. 2006). A solution that addresses noise pollution has been presented by the Sony Labs Paris and is now maintained at Vrije Universiteit Brussel[16]. The system NoiseTube uses mobile phones as acoustic sensors and records noise levels along with location data. These are combined in a noise map to raise the awareness for urban noise pollution. In addition, labels reflecting the noise sources can be assigned by the users or inferred by the system (Maisonneuve et al. 2010).

While many of these research projects have yet outgrown the realm of grassroots initiatives, only few have been incorporated in the official services of local governments

[12] Street Bump, New Urban Mechanics, Boston, USA (www.newurbanmechanics.org)
[13] Center for Embedded Networked Systems (CENS), University of California Los Angeles, USA(http://research.cens.ucla.edu)
[14] Common Sense, Intel Labs Berkeley, California, USA (www.communitysensing.org)
[15] CarTel, Computer Science and Artificial Intelligence Laboratory, Massachusetts Institute of Technology, USA (http://cartel.csail.mit.edu)
[16] NoiseTube, BrusSense group, Vrije Universiteit Brussel, Belgium http://noisetube.net)

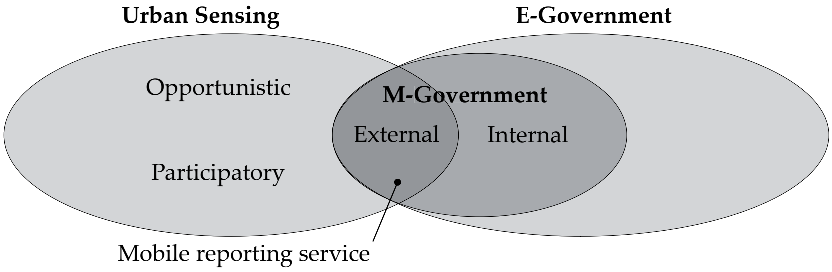


Figure 4.11: Field of research

and reached a broader user base. One of the reasons for this may lie in a low acceptance of urban sensing applications among administrative stakeholders and a lack of insights on the potential benefits. Nevertheless, when a governmental body acts as the recipient of sensing information, similar to the two examples mentioned above (NYC311 and Street Bump) we can instantly relate this stream of research to the emerging field of Mobile Government.

Mobile Government

Mobile Government (M-Government) can be defined as an extension of E-Government *involving the utilization of all kinds of wireless and mobile technology, services, applications and devices for improving benefits to the parties involved in E-Government* (Kushchu and Kuscu 2003). Depending on the target group, we may further differentiate between internal and external M-Government. The former is mostly concerned with equipping governmental staff (e.g., traffic wardens, food and veterinary inspectors, fire-fighters and police) with mobile devices to improve internal processes. External M-Government refers to applications that offer mobile services to the customers of government agencies (i.e., citizens and businesses) and expand the current service offering to this new channel of communication. Participatory urban sensing promises new applications particularly for external, citizen-centric M-Government (Rossel et al. 2006). Figure 4.11 illustrates the relationship between the mentioned fields and positions the service that his study addresses.

Challenges and success factors of M-Government (i.e., internally and externally) are addressed by a number of authors (see Napoleon and Bhuiyan 2010 for a more structured overview). The most critical issues on user level are particularly seen in accessibility, user friendliness, quality, convenience, privacy as well as user education (Al-khamayseh et al. 2006; El-Kiki and Lawrence 2007; Kumar and Sinha 2007; Kushchu 2007; Sandy and McMillan 2005). From a technological perspective, authors also emphasize the availability of communication networks, payment infrastructures, security requirements and compatibility between different online and mobile E-Government channels (Kushchu and Kuscu 2003; Kushchu 2007; Winkler et al. 2011b). Economically, most works find that governments view investments in M-Government technologies as a means to achieve potential savings (Sandy and McMillan 2005; Winkler et al. 2011b), rather than simply a cost factor. Organizational challenges can be that sometimes centralized governance, political support and process re-engineering are necessary to leverage these cost advantages (Borucki et al. 2005; Sandy and McMillan 2005; Winkler et al. 2011b). However, other authors find that M-Government initiatives primarily occur at the local level and rarely cause structural changes (Borucki et al. 2005).

Prior work on M-Government also suggests that due to these drivers and inhibitors of adoption, agencies place more emphasis on internal than on external M-Government projects (Winkler et al. 2011b). As many local governments are facing continual pressure to save costs, the benefits in internal processes appear more tangible and hence receive a higher priority. Moreover, government employees can be regarded of as a more controllable group of users, so that possible user-level acceptance issues can be better mitigated (Winkler et al. 2011b). In contrast, citizen-centric mobile applications are often perceived as a dispensable feature reserved for those municipalities that can still afford to experiment with new innovations (Winkler and Ernst 2011). This reluctance and risk aversion is consistent with the broader literature, which generally views the public sector to lag behind the private economy in innovation adoption (Kamal 2006) This is particularly lamentable from a citizen participation standpoint inasmuch as a recent study indicates that urban sensing tools actually do provide significant means for citizens to participate in urban management (Winkler et al. 2012a).

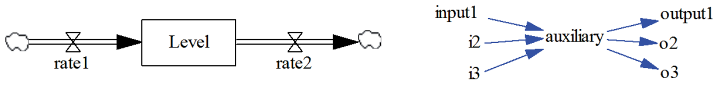
Altogether, given that one of the main barriers of external M-Government adoption particularly consists in the perceived uncertainty of process and cost improvements, researchers may take a closer look at evaluating the benefits of urban sensing as a means of citizen-centric Mobile Government.

Benefits Case Appraisal and System Dynamics

The appraisal of information systems (IS) benefits, or more broadly, the question how information systems create value, has ever been a center of gravity in the IS literature (Schryen 2010). The literature provides a number of measures and methods to evaluate IT investments prior to implementation (Ballantine and Stray 1998), also specifically for an E-Government context (Prakash et al. 2001). Besides financial and operational indicators, these often include qualitative aspects such as benefits and risks (Ballantine and Stray 1998; Farbey et al. 1999; Irani et al. 2002; Prakash et al. 2001). However, more recently authors also emphasize that the success of an evaluation (i.e., whether the expected benefits have been appropriately estimated) is not solely dependent on the appraisal method. These authors demand to view the investment decision as a staged process that primarily targets at aligning the interests of involved stakeholder groups (Irani 2002; Ward et al. 2008). In this context, a *benefit case* refers to a high-level appraisal at the earliest stage of a project to justify the commencement before a detailed business case can be conducted (Wallace 2007).

During the appraisal process, stakeholders face different information requirements (e.g., for quantifying relevant benefits), knowledge requirements (e.g., in understanding

Notation



Formal $Level = \int_{t_0}^{t} \left[rate_1(t) - rate_2(t)\right] dt + Level(t_0)$ $auxiliary(t) = f(i_1(t), \ldots, i_n(t))$

Script `Level = INTEG(rate1-rate2, L_t0)` `auxiliary = ...`

Figure 4.12: System Dynamics syntax

the appraisal technique) and organizational problems (e.g., a lack of time and interest) (Ballantine and Stray 1998). For this reason we find rather simple methods among the most common methods for evaluating risks and uncertainty, such as brain storming and scenario planning, while simulation and other sophisticated techniques rank on the lower places (Ballantine and Stray 1998). However, these simple appraisal methods are often not able to sufficiently capture the complexity of a target domain, such as dynamic and mutually dependent behavior of variables (Farbey et al. 1999). Especially regarding the benefits of external M-Government services, where many variables of adoption lie outside the scope of the organization and only limited prior knowledge is available, there is high uncertainty in the investment evaluation. Therefore the use of an appropriate appraisal technique, that is both comprehensible to stakeholders and still able to capture the variable behavior of the target domain, appears to be of even greater importance.

System Dynamics (SD) is a method developed by Forrester (1961) and his colleagues, originally employed for explaining managerial and industrial problems. It essentially combines a notation for modeling complex systems with a mathematical representation to simulate a model behavior discretely over time. The main components of a model are level and rate variables, as well as inputs (i.e., constants, parameters or lookups) and auxiliaries. Mathematically, a model corresponds to a set of coupled first-order differential equations. The main feature of a dynamic system is presented by loops between variables, leading to reinforcing or balancing feedback behavior. In this sense, SD has the advantage to make complex systems comprehensible by disaggregating them into chains of cause-effect relationships and thus facilitates the solution of intricate decision problems. Prior authors have argued that this can be particularly helpful to improve communication in public decision making (Stave 2002). A summary of the basic SD syntax is presented in Figure 4.12.

Despite its origin in the field of management, SD has been used for a wide range of hard and soft modeling problems in physics, biology, psychology and other domains. SD has also been employed in strategic project management contexts to evaluate investment decisions and project benefits (Lyneis et al. 2001). In the field of Information Systems, for example, SD has been used to evaluate investments into IT security and the effect on the number of attacks (Behara et al. 2007) as well as to model the benefit realization in the adoption of enterprise resource planning systems (Heijkoop and Cunningham 2007). Therefore we contend that SD is also a useful method to evaluate the diffusion and municipal impacts of participatory urban sensing. In our work, we use a SD simulation in a real case from this problem domain and thereby obtain further insights on its practical applicability.

4.4.4 Research Method

Our approach for developing and validating the proposed simulation model took place in three main stages and has been oriented in an action design research methodology.

Methodological Perspective

Design research primarily seeks to address practical needs in a generalizable way through creating new and innovative artifacts (Hevner et al. 2004). Artifacts in this sense have been classified as constructs, models, methods and instantiations (March and Smith 1995). Our simulation model can be regarded as an artifact of the type *model* inasmuch as it aims to “aid problem and solution understanding” and the “exploration of the effects of design decisions and changes in the real world” in the domain of external M-Government services (Hevner et al. 2004, p. 79). However, design research assumes that building and evaluating an artifact follows a clearly sequenced approach and thus implicitly separates the design process from its organizational application (Sein et al. 2011).

Our case organization has been studied and accompanied for a period of over 1.5 years, counting from the first impulses for implementing a mobile reporting service until its rollout and incremental use by the citizens. For this reason, the development process was inevitably characterized by several iterations as well as interventions of the researchers, which have potentially influenced both the design of the artifact as well as the design and implementation of the mobile reporting service itself (Baskerville et al. 2007). Action design research (ADR) approaches have emerged as an alternative methodological lens that explicitly accounts for the iterativeness in the design process as well as the interventions by the researchers. More than that, ADR has been positioned as a design approach that can reflect the “theoretical precursors and intent of the researchers, but also the influence of users and ongoing use in context” (Sein et al. 2011, p. 40).

Depending on the source of innovation in the designed artifact, ADR differentiates between organization-dominant and IT-dominant research approaches (Sein et al. 2011). Since the primary focus of the presented simulation models is on facilitating organizational decision-making (and not on developing the reporting service itself), our research can be clearly classified as an *organization-dominant* approach. ADR posits that the methodological approach should comply with several principles in order to ensure that artifacts are both practically relevant and theoretically rigorous. These principles relate to: (1) inspiration through practice, (2) ingraining through theory, (3) reciprocal shaping, (4) mutually influential roles, (5) concurrent evaluation, (6) guided emergence, and (7) generalized outcomes (Sein et al. 2011). Therefore at its core, ADR foresees an interwoven design process of building, intervention and evaluation (BIE) activities.

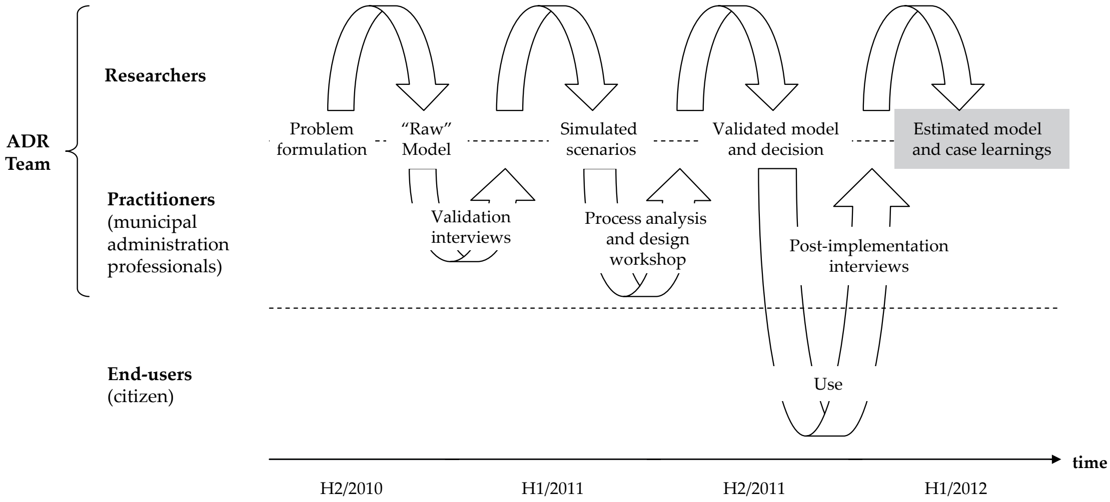


Figure 4.13: Build, evaluation, intervention cycles (adapted from Sein et al. 2011)

Research Stages

Although the process for designing and evaluating the proposed decision model was potentially not as highly interwoven as ADR would posit, it was clearly characterized by three distinguishable BIE cycles. These stages and evaluation cycles are depicted in Figure 4.13. We will use a chronological order to describe the major activities, outcomes and the interactions between researchers and practitioners (i.e., the "ADR team", Sein et al. 2011) in each stage.

The contact to the City of Saarbrücken (south-western Germany) originated from prior research on M-Government adoption. The municipality (represented by the Head of IT Coordination) had expressed a major interest in evaluating the benefits of external E-Government services. In a fist interaction regarding this research in late 2010, the Head of IT Coordination stated that lack of cross-functional thinking and uncertainty regarding the potential benefits were some of the reasons why this topic had been given little attention in the past (problem formulation). The researchers developed a first version of the presented simulation model (*raw model*). In addition they prepared a catalog of questions to acquire more information (e.g., internal instructions and documentation) and to determine the first set of parameter values (e.g., for those related to street inspectors). The validation interviews with the Head of IT Coordination and the Chief of the Department for Street Maintenance took place in February 2011.

The raw model was refined in a second iteration. The researchers conducted a survey and extensively drew on secondary data to make additional parameter estimations (especially for variables related to adoption and diffusion). Different scenarios were simulated based on the given assumptions. In May 2011, the ADR team organized a workshop that embraced a total of seven stakeholders from different departments and entities (IT

Coordination, Street Maintenance, Public Relations, Office for Data Privacy, Internal IT department, Regional Association of Communal IT Providers) which allowed for a broad assessment of related benefits and concerns. The goals of the workshop were (a) to validate the model through a detailed process analysis and determine missing data (especially the costs for processing reports) and (b) to present results of the model scenarios and using them as quantitative basis for discussing solution design options.

(a) Process modeling can be regarded as a valuable validation method as it enables a common understanding of a domain of interest (Aguilar-Savén 2004). Compared to the SD model, where flows are aggregated to continuous variables, process models provide a more detailed representation of a process by assuming a discrete task and event logic (Melão and Pidd 2000). The validation facilitated the researchers with a structured method to acquire the missing information from practitioners and their perceptions about the relevant activities. Furthermore, practitioners themselves, who pertain to diverse departments, got to a comprehensive understanding of the entire process which may likewise have improved their ability to understand the domain of interest, in our case the defect management procedures. (b) Two model scenarios (optimistic and pessimistic) were presented to the workshop participants and enabled a discussion on further qualitative aspects and design options for a mobile reporting service. For instance, the simulation supported the reasoning about appropriate means for handling the anticipated amount of citizen reports. Comprehensive workshop documentation was subsequently provided to the participants (see Appendix 4).

As a consequence of this joint workshop, the municipality (in responsibility of the Head of Public Relations) decided to include a mobile reporting service in a planned mobile offering, which was originally intended to incorporate merely non-transactional services (i.e., no urban sensing or similar functionality). Application development and server operation was organized through a public-private partnership between the municipality and a local information portal operator. In September 2011, the city launched the first version of the city's official mobile application for one popular mobile platform[17]. The application includes an event calendar, city walks, information on the zoo, as well as a mobile reporting service called 'Mängelreporter' (defect reporter). Application downloads as well as incoming reports from citizens grew steadily.

After about half a year of operation, the researchers conducted post-implementation interviews with the Heads of IT Coordination, Street Maintenance and Public Relations to evaluate the first learnings and obtain detailed usage statistics. Worth noting, in April 2012 the Saarbrücken mobile application has been awarded the prize as best municipal app in a national competition at a major IT trade show, which was according to the Head of Public Relations also due to the Mängelreporter. The Head of IT-Coordination emphasizes that "the initiative from researchers in the area of urban sensing was crucial for the decision of whether integrating a mobile reporting service into this offering."

[17]see www.saarbruecken.de/de/rathaus/medien-_und_buergerkommunikation/saarbruecken-app

4.4.5 Simulation Model

The simulation model used in this research consists of four parts: (1) a diffusion model for the adoption of a mobile reporting service among a city's inhabitants, (2) a deterioration model that simulates the occurrence of new infrastructure issues, (3) a reporting model that estimates the number of reported issues, and (4) a cost model. We will describe each of these submodels separately by highlighting the required inputs, the underlying assumptions, and the characteristic functional relationships. The modeling and simulation was performed with Vensim PLE software. An overview of the entire model is provided in Figure 4.14. A full list of equations can be found in Appendix 3.

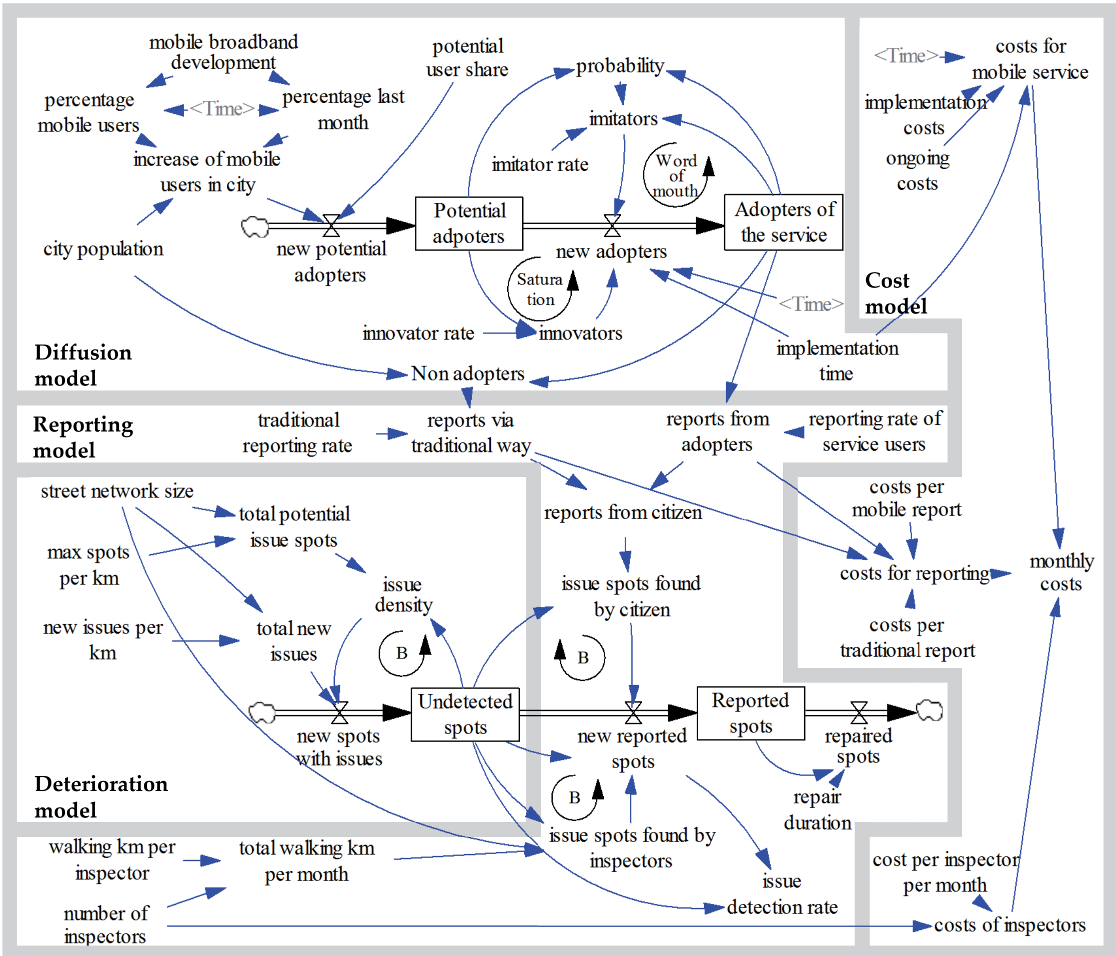


Figure 4.14: System dynamics representation

Diffusion Model

The diffusion model estimates the number of adopters of a mobile reporting service in the municipality of interest. One of the most famous approaches for predicting adoption is the model introduced by Bass (1969), who extended innovation diffusion theory by Rogers (1962) by a mathematical representation. The Bass model is based on the behavioral assumption that the probability for a new product being adopted in period t is a linear function to the number of previous adopters A_{t-1}.

$$P\left(a_t\right) = p + q\frac{A_{t-1}}{M} \tag{4.1}$$

This probability is composed of two influences. The first is the influence represented by the rate of innovators p who adopt a product independent from the number of previous adopters. The second is given by the rate of imitators q whose adoption is dependent on the share of past adopters by the total market size M (i.e., the relative past adoption). This share has also been interpreted as a probability of *contagion* or *word-of-mouth* from adopters to non-adopters. The Bass model has been transferred to a SD representation by Sterman (2000, p. 332). This model accordingly contains a balancing loop that determines the rate of innovation, and a reinforcing loop which adds the imitators to this to obtain the number of *new adopters* per period (a_t)

We embed the Bass model into our context of a mobile reporting service by defining the following input parameters:

- *City population*: the number of inhabitants of the city [citizen]
- *Mobile broadband development*: the share of users of 'smart' mobile devices on country-level [lookup]
- *Potential user share*: the expected share of users who would install the mobile reporting application [dmnl]
- *Implementation time*: the time t_i after t_0 when the mobile reporting service is released [months]
- *Innovators rate*: the share of potential adopters that would install the new application [1/month]
- *Imitators rate*: the pressure on potential adopters to imitate the adopters [1/month]

The level of *potential service adopters* at t_0 is initialized with the *percentage of mobile users* among the *city population*, multiplied with the *potential user share*. Obviously, only users of a smart device can potentially adopt the service and install a mobile reporting application on their device. The share of *new potential adopters* in a city is moderately increasing with the overall *mobile broadband development*. When the *implementation time* t_i has been reached, the *innovators* among *potential adopters* incrementally become *new adopters*. Once the number of *adopters of the service* increases, the number of *imitators* increases and adds up to the *new adopters*. However, the *probability* for this word-of-mouth advertising decreases with the decreasing number of potential adopters.

The equations of the diffusion model are listed in Appendix 3.

Deterioration Model

The deterioration model simulates the occurrence of issues in the urban street infrastructure. The following inputs are required:

- *Street network size:* determines the total urban space where infrastructure issues occur [km]
- *Max spots per km:* limits and discretizes the potential spots where issues occur [spots/km]
- *New issues per km:* describes the constant occurrence of new issues on these spots; in other words the natural deterioration of urban infrastructure [issues/km/month]

This process assumes that a street kilometer is segmented into a number of spots (for example 1,000 spots with each 10 square meters of space, assuming that the average street width is 10 meters). Issues (e.g., potholes, waste, broken trees etc.) occur randomly within these spots. Since several *new issues* may fall on the same spot, the number of *new spots with issues* is less or equal than *total new issues*. (This also implies that spots can infinitely 'get worse'.) Logically, the probability for such overlap increases the more spots already have problems, i.e. the higher the *issue density* is. Thus, overlapping issues still represent a single new spot with an issue, since it would still require a single report to the municipality. Before being reported, issue spots account up to the level of *undetected spots*. The equations of this submodel are given in Appendix 3.

Reporting Model

The reporting model connects the deterioration model with the diffusion model. Municipalities typically employ dedicated workforce for inspecting urban infrastructure. The model calculates the number of reported issues based on the number of reports from these street inspectors, plus those from citizens that have adopted the mobile reporting service. The following inputs are required to parameterize this submodel:

- *Traditional reporting rate*: number of infrastructure issues reported via conventional means such as email and telephone [report/month]
- *Reporting rate of service users*: number of reports per adopter of the service [report/month]
- *Number of inspectors*: permanent workforce for inspecting streets [inspector]
- *Walking km per inspector*: the average length of the street network that an inspector controls per month [km/inspector/month]
- *Repair duration*: average duration for removing issues that have been detected [month]

The model assumes that *reports via traditional means* are issued by non-adopters whereas *reports from the adopters* replace traditional channels of communication. The total number of *reports from citizens,* as well as the level of *undetected spots* are used to calculate the actual *issue spots found by citizens.* Similar to the issue generation model, reports from citizens are likely to overlap, e.g. if several citizens report the same spot with a pothole. In this case, the problem can be referred back to an occupancy problem, where citizens randomly distribute x balls (x=*number of reports*) on N urns (N=*number of undetected spots*). According to Grottke and Rässler (2003, p. 6), the expected value for the number of urns occupied with at least 1 ball (U_x=*issue spots found by citizens*) is given by the following equation

$$E\left(U_x\right) = N \cdot \left[1 - \left(1 - \frac{1}{N}\right)^x\right] \tag{4.2}$$

At the same time, issues are detected by the city's street inspectors. Street inspectors accomplish a certain amount of *total walking km per month.* We assume that undetected issues are geographically equally distributed over the street network and that street inspectors find all the issues on their way, so that the share of *issue spots found by inspectors* on *undetected spots* is presented by the fraction of the total street network size covered. The effectively *new reported* spots ($\mathrm{s}_{\mathrm{C \cup I}}$) are given by the sum of spots reported by citizens (s_C) and by inspectors (s_I), subtracting the spots $s_{C \cap I}$ that overlap between the two sets. We assume that the citizens' reports are equally distributed over the street network. Therefore, the expected share of the overlapping spots by s_I is equal to the share of s_C by all undetected spots s_U. We can write

$$\frac{s_{C \cap I}}{s_I} = \frac{s_C}{s_U} \quad \overset{\text{in } s_{C \cup I}}{\Longrightarrow} \quad s_{C \cup I} = s_C + s_U - \frac{s_I \cdot s_C}{s_U} \tag{4.3}$$

This variable $\mathrm{s}_{\mathrm{C \cup I}}$ reduces the level of *undetected spots* and adds up to the level of *reported spots.* That is, citizens and street inspectors would not report these infrastructure issue anymore, as they have been logged and appear in the municipalities reporting system with an according status of processing. The *issue detection rate* can be regarded as a performance indicator for the overall effectiveness of this process. The further removal or repairing of an issue takes an average *repair duration* and takes place subsequent to issue reporting. The equations of the reporting model are given in Appendix 3.

Cost Model

The cost model sums up the *monthly costs* related to infrastructure reporting, i.e. costs for the mobile reporting service, for the processing of reports and for street inspectors. For this purpose, a few input variables are required. The detailed equations employ simple arithmetic, see Appendix 3.

- *Implementation costs*: the onetime costs for implementing the service in t_i, e.g. for application development or purchasing licenses [EUR]

- *Ongoing costs*: the running expenses of the mobile reporting service, e.g. for perpetual licenses or application maintenance [EUR/month]
- *Costs per traditional report*: average variable costs for reviewing, classifying and processing issues reported via phone or email [EUR/report]
- *Costs per mobile report*: average variable costs for reviewing, classifying and processing issues reported via the mobile service [EUR/report]
- *Costs per inspector per month*: total labor cost per street inspector [EUR/inspector/month]

4.4.6 Case Validation

We validated the correctness and usefulness of the simulation model (our artifact) in course of the different research stages and interventions at the case site of the City of Saarbrücken. This validation includes a detailed process analysis, a model instantiation with case data, the simulation of different scenarios, the assessment of further qualitative aspects and the estimation of model parameters. This section describes each of these steps.

Process Analysis

Process modeling was performed in a workshop with different municipal practitioners and stakeholders. The urban defect management process including defect identification, processing and removal was collaboratively discussed and incrementally drawn on a brown paper using process mapping methods (Biazzo 2002). For reasons of quick comprehension, we used a simple flow chart notation which was later documented by the commonly known business process modeling notation BPMN 2.0[18] and provided to the participants. This documentation consists of (a) an overview of the overall process and (b) detailed documentation of its sub-processes. For reasons of brevity, we will summarize the overall process and highlight two relevant subprocesses to explain, how implementing a mobile reporting service affects these processes.

The overall complaint and defect management process in Saarbrücken is depicted in Figure 4.15. It starts either with a report from a street inspector or with a complaint from a citizen. Citizen complaints are directed to the Complaints Office via telephone, regular mail, email, a website form or—as a new medium—as a message from a mobile reporting service. The Complaints Office generally processes these issues and routes them to the department in charge (e.g., to public order, traffic authority, public utilities, or in the frequent case of infrastructure defects to the Head of Street Maintenance). The same applies to those defects regularly reported by the street inspectors, who are subordinate to the Office of Street Maintenance. Road workers responsible for repairing minor defects (e.g., potholes) are situated locally at the Saarbrücken districts. In some cases, district road workers are requested to perform an additional pre-inspection of an

[18]Business Process Model and Notation, Object Management Group (www.bpmn.org)

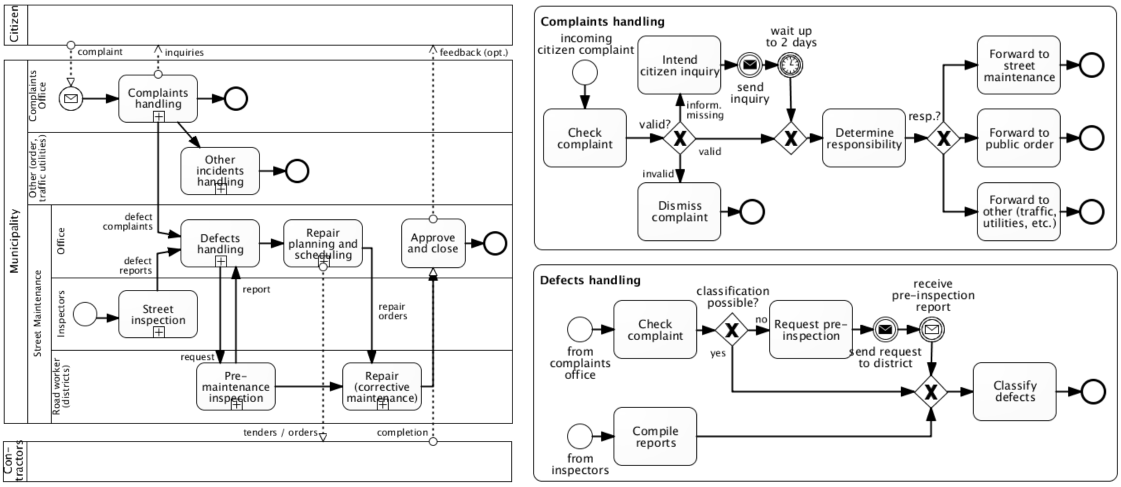


Figure 4.15: Complaint and defect management process and selected subprocesses

issue spot before (instantly or later) starting corrective maintenance (e.g., when size and condition of a pothole are unclear). In cases of larger defects, these are typically bundled and scheduled for a tender to external street construction firms (e.g., for asphalt coating of an entire street). Both repair works from the wards as well as those by external contractors are approved by the Head of Street Maintenance when completed. In case the repair was due to a complaint, usually a feedback to the citizen is provided.

Based on the process analysis, we find that the principal flow of the defect management activities is not affected by the existence (or non-existence) of a mobile reporting service. That is, the Complaints Office remains the main interface to the citizens so that the reporting service simply represents an additional communication channel. Nevertheless, the analysis reveals two main levers in the complaints and defect handling subprocesses where the choice of the medium may strongly affect throughput times, see Figure 4.15 (right side).

Regarding the complaints handling subprocess, the Head of Public Relations states that many incoming messages are invalid or do not provide sufficient level of information (e.g., regarding the precise location of a defect). Such messages cause additional time and effort for inquiring the missing details with the citizen (if possible) instead of being instantly forwarded to the department in charge. (This is considered later as *costs per mobile report* for the model instantiation in Section 4.4.6). Arguably, with the use of a mobile reporting service, which includes on-the-spot location coordinates and possible photos, the need for further inquiries and hence processing times can be reduced.

A similar effect is expected for defects handling. The Head of Street Maintenance states that defects reported by citizens are usually no support for their work at all, since they caused more effort for sending road workers and performing pre-inspections than they actually save in preventing damages. Even in some cases, the pre-inspectors are unable to locate the reported spot so that additional feedback loops with the Head Office and citizens are required. This would certainly change if the report featured precise location coordinates and a photo, as the interviewee affirms.

Altogether the process analysis indicate (a) that the assumptions made in the presented system dynamics model match the concrete process instance at the Saarbrücken municipality, and (b) that there are certain levers associated with the use of a mobile reporting service that would facilitate the process flow and reduce processing times.

Model Instantiation

Based on the case analysis, the simulation model has been instantiated with values of the Saarbrücken municipality, survey data and information from further data sources. We use the submodel logic to explain the parameters used and how they have been estimated.

Regarding the diffusion model, we retrieved the percentages of the *mobile broadband development* in Germany from the annual report of the International Telecommunication Union (ITU 2010). These figures have been extrapolated by a time dependent lookup function from the years 2011 to 2016 in the system dynamics model, growing from 35% to 68% of the population. (Arguably, there would be a good argument to simulate this growth as a Bass model as well; however, we opted for a static function due to the good availability of past information on this variable).

The values for *innovator rate p* and *imitator rate q* determine the speed of adopting the mobile reporting service (i.e., the slope and skewness of the new adopters curve). Higher values generally signify that a product is more 'contagious' and q is generally greater than p (usually for a factor greater than ten, (Mahajan et al. 1995, p. 82). We reviewed several diffusion studies of technology products, for example, on mobile phones in Spain (Cronrath and Zock 2007), and on an automatic telephone enrollment service at a New Zealand university (Wright et al. 1997). Plausibly, the closed user group of an enrollment service exhibits a much faster adoption compared to the macroeconomic diffusion of mobile phones, which explains why the p, q-parameter estimates of both studies are similar despite being measured on different time scales (annual versus fortnightly). (Note that normally innovation diffusion parameters behave approximately proportional to the measurement scale, e.g. annual parameters are about twelve times the monthly parameter estimates (Putsis 1996). We assume that a mobile reporting service on urban level ranks between those two cases and choose (monthly) parameters for our model which are slightly less than half of the fortnightly parameter estimates of the New Zealand example (p=0.02, q=0.2). While we acknowledge that these are rough estimations, we consider them as sufficient for the purpose of scenario simulation since they only influence the speed, but not the overall level of adoption and incoming reports. *Implementation time* is set to 5 months for illustrative purposes (which equals the time from the workshop to the implementation in the case example).

The most influential variables of the diffusion model, however, are the *potential share* and the estimated *reporting rate of service users* since they determine the total amount of reports that the municipality expects to receive from citizens. Ex-ante, these variables

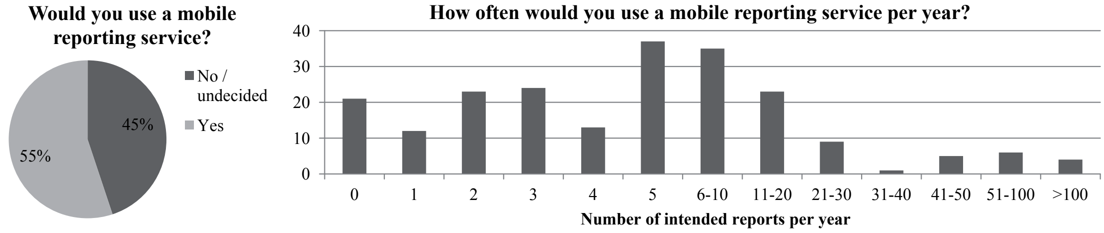


Figure 4.16: Survey results

are hard to determine and therefore subject to uncertainty. Nevertheless, we draw on technology adoption theory (Davis et al. 1989) and assess the *intended* reporting rates as a proxy. For this purpose, we conducted a survey with potential service users across all age groups and professions. The survey was administered online and distributed via email across the personal networks of the authors. It contained an introduction to the topic and, amongst other items, a question on each of these parameters of diffusion. We effectively received n=213 usable responses, 48% from male and 52% from female respondents. Regarding occupation, 28% stated to be students, 37% working, 10% retired, and 11% others. The distribution of the considered survey variables are depicted in Figure 4.16.

According to the survey, 55% of mobile phone users would use a reporting service. The median (and also the mode) of intended reports per year is 5. We view these unexpectedly positive results with caution. While intended and actual technology adoption are clearly related (with typical correlation values in the range of 0.20 - 0.30, (Davis et al. 1989), the literature provides numerous influences that moderate and distort this relationship. Such influences may result from (1) factors that affect the accurate expression of current intentions and (2) factors that affect the accurate prediction how these intentions will change over time (Morwitz 1997). Regarding the former, one bias in our setting may a particularly result from the survey setting and the respondents' tendency to give socially desirable answers (Richman et al. 1999). For example, studies in the field of health behavior found that people translated their 'good' intention into action in about 50%, i.e. half of the cases (Sheeran 2002). However, while the literature demonstrates a significant correlation between intention and use, concrete 'rules of thumb' how to translate intended into expected usage frequencies are widely absent. To account for this uncertainty, we assume two scenarios: an *optimistic scenario* with a 22.5% (half of the stated 55%) potential user share and 2.5 (half of the mean 5) reports per user per year in line with the survey data and the references from behavioral studies, as well as a *pessimistic scenario* with a 5% potential user share and an average 1 report per user per year. For comparison, the average *traditional reporting rate* in the city Saarbrücken with 180,000 inhabitants is 15 reports per month.

Regarding the deterioration model, internal documentation informed that the *street network size* of Saarbrücken amounts to 665 km. We discretize a street km into 1,000 *max spots per km*. Streets are classified by priorities according to the intervals in which they need to be checked in order to comply with the city's due diligence. We learned that the city employs a *number of 6 inspectors* in the Department of Street Maintenance to do this job fulltime. We calculate that per month, each of the inspectors controls an average 40 km of the overall network. On his route, an inspector encounters in average 8 issues per km; that is, if streets were checked monthly, this occurrence would account for approximately 3 *new issues per km* per month.

Finally, we instantiate the cost model. In our case setting, a municipal inspector incurs about 50,000 Euro of total labor cost per year. Costs per report can then be calculated as differential process costs (Drury 2007). That is, we account only for the times for handling and processing citizen reports from receipt to repair (excluding material cost and overhead). Based on the process analysis, the workshop participants estimate that a defect report via traditional channels takes an average 20 min and a mobile report 10 min (due to less citizen inquiries) for classifying and routing within the municipal administration. Additionally, traditional reports are more likely to cause pre-inspections. The average (conservatively) estimated surplus for pre-inspections is 10 min (i.e., about 2 hours for one out of twelve defects). For demonstrative purposes, *implementation costs* are set to 10,000 EUR. The input variables and their values are summarized in Table 4.13.

Scenario Simulation

We instantiate and simulate the model according to the two different scenarios (optimistic and pessimistic scenario) and compare these with a baseline scenario, i.e. the case if no mobile reporting service was implemented at t=5. For an additional comparison, we run a pessimistic scenario where one inspector less is employed by the municipality (i.e., *number of inspectors*=5). Four selected variables from the model are depicted in Figure 4.17.

Regarding the diffusion model, the results show that the number of *new adopters* describes the typical bell-curved shape postulated by innovation diffusion theory (Rogers 1962). In month 17, i.e. 12 months after the service is taken in use, the curve peaks at 1072 new adopters for the optimistic, and 238 for the pessimistic scenario. The curve is notably skewed whereas its long tail is superimposed by the overall *mobile broadband development* and an ongoing increase in new mobile phone users.

In terms of deterioration, it is obvious that the model first needs to get into equilibrium, since we start with a city free from defects (0 *undetected spots* in t_0). As we can see from the baseline scenario, this equilibrium is at an *issue density* of 0.82% within the urban space. However, in the optimistic scenario, this measure for the deterioration goes down after the adoption due on the large number of reports that the municipality receives and converges to 0.03%. This is also reflected in the percentage of issues that are detected. In the optimistic scenario, the *detection rate* increases to about 96% (in t=60). That means that practically every uprising issue would be immediately reported by the collective monitoring of the citizens. In the pessimistic scenario, the detection rate climbs up from 36.3% in the baseline scenario to about 42.3% in t=60, reducing the *issue density* to 0.7%.

Table 4.13: Simulation model parameters

Parameter	**Value**		**Unit**[a]	**Source**[b]
	Opt.	Pess.		
City population	180,000		Citizen	Case
Mobile broadband dev.	35% - 68% (2016)		Dmnl	ITU 2010
Implementation time	5		Nonth	Assumption
Potential user share	0.225	0.05	Dmnl	Survey, Sheeran 2002
Innovators rate (p)	0.02		1/mth	Mahajan et al. 1995; Putsis 1996; Wright et al. 1997
Imitators rate (q)	0.2		1/mth	
Street network size	665		Km	Case
Max spots per km	1000		Spots/km	Assumption
New issues per km	3		Problem/km/mth	Case
Traditional reporting rate	15/180,000		Reports/citizen/mth	Case
Reporting rate of users	2.5/12	1/12	Reports/citizen/mth	Survey, Sheeran 2002
Number of inspectors	6		Inspector	Case
Walking km per inspector	40		Km/inspector/mth	Case
Repair duration	2		Mth	Assumption
Implementation costs	10,000		EUR	Assumption
Ongoing costs	100		EUR/mth	Assumption
Costs per mobile report	1.68		EUR/report	Case
Costs per traditional report	4.91		EUR/report	Case
Costs per inspector	50,000/12		EUR/mth	Case

[a]Dmnl = dimensionless; mth = month
[b]Simulation results are invariant to variables for which assumptions have been made

With regard to process costs, we note that in the pessimistic scenario, after month 5 (and the initial investment peak for service implementation), *monthly costs* increase by +3.4% compared to baseline scenario (25,934 vs. 25,073 EUR/month until t=60) due to the increased efforts for processing reports from citizen. However, if we reduce fix cost by setting the *number of inspectors* to 5, then monthly costs are even below baseline by -12.9% (21,823 EUR/month). This is remarkable in view of the fact that the *issue detection rate* in this scenario almost equals the baseline level (36.2% in t=60). In other words, the results indicate that participatory sensing can provide a comparable level of information about the urban infrastructure at lower cost than single street inspectors, given there is a moderate participation by the citizens.

However, the chart on *monthly costs* also reveals one of the major risks of implementing such service: If the level of citizen participation exceeds the expectations, such as in the optimistic scenario, high costs and efforts accrue for processing the citizen reports without

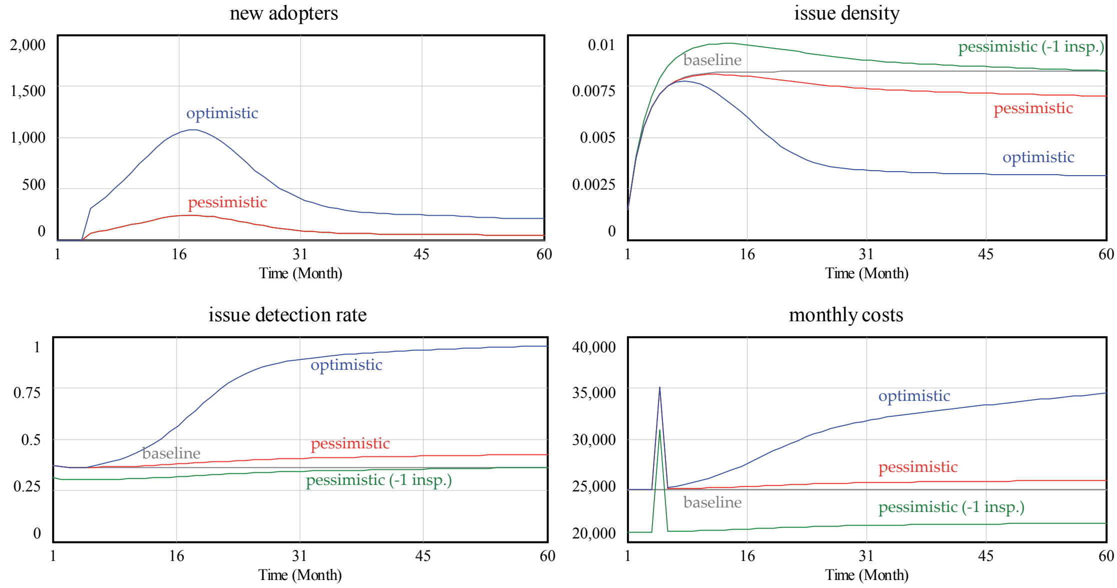


Figure 4.17: Simulation results (selected variables)

achieving any additional benefit in issue detection. Both scenarios have been presented and discussed to the stakeholders in the Saarbrücken case.

Qualitative Analysis

The presentation of the simulation results, besides providing indicative evidence of the potential benefits and risks, also fostered the discussion on further qualitative aspects connected to the implementation of a mobile reporting service. These aspects related to both expected benefits and potential concerns from which we can derive (functional and non-functional) design requirements that need to be addressed during a system implementation (Maciaszek 2007). For example, the quantification of expected adopters and incoming messages helped to balance between privacy requirements and performance goals when deciding on the question of whether citizens would need to enter personal data with every report or not. Qualitative aspects can be broadly classified into four categories: user, process and organization, privacy and legal, as well as technical aspects. We will briefly summarize each of these points, see Table 4.14.

Workshop participants stressed the importance that the client application of a mobile reporting service should possess high usability and enable easy interaction to outmatch traditional channels of communication. An additional feature refers to the tracking of reported issues, i.e. the mobile reporting service could communicate the status of issue processing and communicate this to the citizens. However, this may also raise the citizens' expectation that issues are taken care of at a faster pace (which can not necessarily be guaranteed). Therefore the issue status should only be presented to the sender.

Table 4.14: Qualitative aspects of introducing mobile reporting

User aspects	**Process and organization**	**Privacy and legal aspects**	**Technical aspects**
• Easy interaction • Issue tracking • Improved communication • Exceeded expectations • Increased satisfaction	• Increased report quality • Reduced throughput times • Accident prevention • Analytics • Routing across municipalities	• Needed citizen data • Defined terms of use • Deletion after closing • Transparency issue • Photo third party rights • Liability in imminent danger	• Message filtering • Broadband coverage • Less media disruptions • Integration with ticketing system

Altogether it was found that a mobile reporting service can improve the communication between the citizen and municipal administration (i.e., to make it more efficient and more effective), which is ultimately also expected to have a positive effect on citizen satisfaction.

Regarding process and organization, the process analysis revealed that due to the standardized form of a mobile report (including location coordinates and potential photos) the quality of citizens' reports is expected to increase. This can have positive effects on throughput times for complaint and defect handling, since additional loops for inquiries to the citizen and for visiting the issue spots are avoided. Furthermore, some workshop participants argued that a mobile reporting service could particularly help to detect hazardous spots faster and thus to prevent from traffic accidents in the urban area. In a more long-term view, the sensing data from citizens could also be used to perform analytics and thus gain additional knowledge on problem areas and general trends. A concern was raised regarding the need for routing reports to other municipalities in case citizens use the service out of other municipal districts.

Several privacy-related and legal aspects need to be considered when implementing a mobile reporting service. First, the data needed from citizens (e.g., for doing inquiries and giving feedback) was a subject to discussion. However, there was a consensus that data needs (especially for the location) should be stated clearly in the terms of use of the service and deleted after closing of a case. Publishing open issues (including photos) on the client application or a website and thus creating full transparency was viewed rather critically not only for raising false citizen expectations but also to avoid abuse and protect the rights of potential third parties (e.g., passers-by pictured on a photo). Finally, dealing with urgent issues and the liability in imminent danger (e.g., due to a missing street drain cover) was perceived as a concern inasmuch as in these cases the administration would still prefer to receive a phone call.

One important technical aspect refers to implementing appropriate mechanism for filtering redundant or invalid reports in order to prevent from information overflow (as shown in the simulation of the optimistic scenario). Further concerns relate to a lack

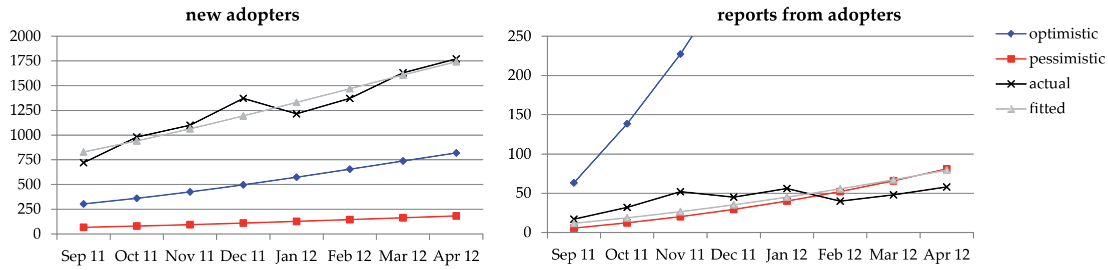


Figure 4.18: Estimated and actual adoption curves

of broadband coverage in rural areas as well as indoors (e.g., in subways). Regarding internal process flow and the support through IT systems, it was argued that a mobile reporting service would help to overcome media disruptions at the start process (e.g., compared to phone and email). This could be achieved through implementing an entire workflow management system which is integrated with the ticketing system used in the complaints office. Altogether the discussion unfolds a broad set of aspects that are correlated with the implementation of a mobile reporting service and thus need to be considered for the design of such service.

Empirical Estimation and Case Learnings

As a direct consequence of the design workshop, the Saarbrücken mobile application *Saarbrücken App* (including the mobile reporting service) has been implemented and released in mid September 2011. Seven months later, we conducted post-implementation interviews to inquire the major learnings from this project and to obtain first usage figures. The rate of new adopters can be expressed by the monthly number of users who download the Saarbrücken mobile application from the platform provider (i.e., from the 'app store') and install it on their mobile device. The number of incoming reports via this new medium is logged in the municipal Complaints Office, see Figure 4.18. We use these figures to estimate the actual parameters of diffusion and compare them to our previous model assumptions.

The *innovator*, *imitator rates* as well as the number of *potential adopters* (i.e., parameters p, q and M of the Bass model) can be estimated by performing a quadratic regression of the number of *new adopters* on the number of cumulated adopters in t_{n-1} (Bass 1969, p. 219). As 'fitted' model parameters we obtain p=0.019, q=0.156 and M=42,833 (R^2=99%). The number of *potential adopters* also allows us to derive an estimate for the *potential user share*, which would be around 63% according to the fitted model (calculating with 68,400 users of a smart phone in Saarbrücken at t_i, based on the numbers from ITU (2010).

The actual and fitted curves of new adopters are depicted in Figure 4.18. As we note, the actual adoption rates are clearly above the simulated scenarios, just as the calculated *potential user share*. We attribute this to the fact that the Saarbrücken app is as well downloaded for a number of other purposes than mobile reporting and potentially also by other people than local citizens, e.g. tourists. In our last interview, the Head of IT Coordination tells that the most popular part of the application is actually the information page on local movie show times. However, the actual adoption would potentially be even higher if the application had been made available for several mobile platforms. According to our interviewee, many citizens criticized that the application developed for a single operating system discriminates other potential users—a fact that he now considers a major weakness to be addressed in the near future.

In contrast to the application downloads, the incoming reports from citizens are at the lower end of the expected range. A linear regression of the cumulated adopters on the incoming reports shows that the empirical *reporting rate of service users* is 0.0066, i.e. much below the expected rate (presumably due to the high number of downloads not related to mobile reporting). Using this average reporting rate allows us to also define a fitted reporting curve, which approximately coincides with the number of reports in the pessimistic scenario, see Figure 4.18.

Although this short time series regression only allows for a first estimation (Van den Bulte and Lilien 1997), this indicates that the benefits outlined for the 'pessimistic' scenario actually appear quite *realistic*. In our follow-up interview, the Head of the Complaints office emphasizes that about 90% of incoming mobile reports are valid and usable. Concerns related to application abuse could be largely dispelled since the municipality decided to request senders to authenticate themselves with a name and phone number (analogously to traditional phone and email complaints). The Head of Street Maintenance affirms that the existence of a photo in citizens' reports facilitates their work, although their main source of information for urban street maintenance (i.e., the work of the street inspectors) remains unchanged.

4.4.7 Conclusion

In this work we provided insights on the benefits that urban sensing entails for local governments to simultaneously foster citizen participation *and* improve urban service delivery. We chose the example of a mobile reporting service and developed a simulation model that connects the adoption and diffusion of such sensing application with urban deterioration, municipality-internal defect processing and cost-related variables. The model has been validated based on a case study of a large German municipal administration over 1.5 years. The evaluation produced a detailed process analysis, a model instantiation, a simulation of different scenarios, a discussion of further implementation-related aspects, and post-implementation learnings as well as an estimation of the 'real' model parameters.

The results of this research are multifaceted. The detailed process analysis shows that the proposed quantitative simulation model generally fits to the activities and responsibilities in urban complaints and defects management. Thus the model captures the main characteristics of a real-world case well. Furthermore, it reveals that two potential levers of process improvement, namely reduced loops for citizen inquiries and fewer pre-inspections, can arise from the increased information capabilities (i.e., photo and location data) of mobile reports. In course of the model instantiation, we provide reasonable parameters for the proposed simulation model and demonstrate how it can be customized to the context of a specific case municipality. The subsequent simulation of different scenarios suggests that the use of mobile reporting can have substantial benefits in terms of available information (here: detected infrastructure issues) and does not necessarily lead to greater cost compared to internal defect reporting procedures.

Nevertheless, the main purpose of the proposed simulation model is not to provide an argument for introducing urban sensing services based on purely economic considerations—and neither it was the motivation in the given case. Conceptualized as an organization-dominant artifact (Sein et al. 2011), the major strength of this model is to facilitate a comprehensive understanding of the benefits and concerns at the intersecting domain of external M-Government services, which can help to improve communication and foster decision-making in various E-Government implementation contexts. We demonstrated this strength by summarizing the key qualitative aspects that emerged from the discussion with municipal stakeholders and ultimately led to an implementation of the mobile reporting service. These qualitative aspects related to user, processes and organization, privacy and legal, as well as technical categories. Finally, our post-implementation evaluation indicates that the scenario parameters are within the bounds of possibility. Based on the case learnings we provided insights on why the observed deviations occur.

Methodological Evaluation

This research was oriented in an action design research (ADR) paradigm. In the following we use the seven principles proposed by Sein et al. (2011) to evaluate our approach methodologically: 1) Our research has been *inspired through practice* inasmuch as the idea to develop a simulation model was motivated by prior studies indicating that municipalities place less emphasis on *external* M-Government services (Winkler et al. 2011b) and by the municipality's interest in evaluating these opportunities. (2) The proposed artifact is especially *ingrained through theory* by drawing on innovation diffusion theory (Rogers 1962) and—in quantitative terms—on the Bass (1969) model for new product adoption.

Reciprocal shaping took place in three major cycles (validation interviews, process analysis and design workshop, post-implementation interviews) which allowed us to flesh out the details of the model and determine its underlying parameters. Conversely, the quantitative simulation results allowed municipal stakeholders to reason about design requirements for example for handling the anticipated amount of citizen reports. This way, prior uncertainties and a lack of cross-functional thinking (see problem statement) have been addressed effectively. (4) During the design cycles, we observed several *influences* and effects of *mutual learning* among the project participants, not limited to the insights between researchers and practitioners. For example, after our workshop all participants confirmed that the conducted process analysis has provided them with greater understanding about the different ends of the overall complaints and defects management process. (5) Although we present the core artifact and its validation in separate sections, the development and evaluation took place in a largely *authentic and concurrent* manner. This may appear evident as with any new parameter assumption we could instantly test how this change would affect the overall model behavior.

Finally, (6) *guided emergence* denotes that the created artifact reflects not only the preliminary design created by the researchers (i.e., in our case the model itself) but also its shaping by the use in an organization (Sein et al. 2011). We believe that this principle expresses the core finding of this research, in which the use of the model has first led to a broader discussion of implementation-related issues and then ultimately guided organizational decision-making. (7) We provide more *generalized outcomes* as a contribution of this research in the following section.

Contribution

In its nature as a design-oriented approach, the main contribution of this research is represented by the generated artifact, i.e. the simulation model for urban sensing adoption and benefits. Although we instantiated and evaluated this model in a specific case example (Saarbrücken), we argue that this model and our approach can be useful on different levels of problem classes. The narrowest of these classes is certainly the decision on implementing a similar mobile reporting service in a different municipal context. Besides numerous qualitative considerations, we presented a validated model and provided reasonable parameter estimations, so that government practitioners can simply adjust the specific case variables in order to obtain realistic and usable results for their respective city.

However, we put forward that our model and the demonstrated approach are also applicable in a much wider class of problems related to external E-Government services and organizational decision-making. That is, our model might as well be used to estimate the use and impact of other urban sensing applications, such as environmental impact assessment (Mun et al. 2009), air quality monitoring (Aoki et al. 2008), traffic mitigation (Hull et al. 2006), and noise control (Maisonneuve et al. 2010). As we motivated at the outset, many public agencies today struggle with introducing innovative M-Government services and opening this new channel of interaction to their customers (i.e., the citizens) partly due to their inability to moderate the internal decision process (Winkler et al. 2011b). The principal logic of the model (stating that citizen information adds up to the level of organization-internal information and accounting for overlapping information) is likely to remain unchanged across different urban sensing scenarios. Therefore, this model can provide a valuable starting point to assess the potential impact of urban sensing in various emerging application scenarios.

Finally, our findings also contribute to the broader literature on investment appraisal and decision-making (e.g., Ballantine and Stray 1998; Farbey et al. 1999; Irani et al. 2002; Irani 2002; Prakash et al. 2001; Stave 2002; Ward et al. 2008). Our case specifically illustrates how different types of models (more precisely, a conceptual SD model, a detailed process model, and a simulated SD model) can support organizational decision processes at different stages. Our case findings suggests that the 'soft' modeling approaches (such as the SD notation and the process model) facilitate a mutual understanding of the problem domain among the stakeholders, while the 'hard' modeling approaches (such as the mathematical SD simulation) can be used to demonstrate different scenarios and thus (intentionally) enable a discussion on appropriate design requirements. In this sense, this research reconfirms the strengths of system dynamics as a valuable method to address both hard and soft modeling problems in organizational decision-making, especially in a public sector context (Stave 2002).

Limitations and Future Research

Limitations of this study are primarily related to the content of the proposed model, the estimated parameters as well as the selection of a single case site. Since any modeling approach inherently represents a simplification of reality, one may find further potentially relevant variables that did not enter into our model. Also, the time period considered for the empirical estimation of the model parameters (especially for p, q, and M) limits the accuracy of the prognosis on the expected adoption and market sizes. However, as the focus of the proposed SD model was on demonstrating the interrelationships and dependencies of the presented variables, rather than delivering econometric parameter estimations, we consider the parameters as a sufficient approximation for the purpose of scenario simulation in our case of a decision-making context. As more empirical data accumulates, future researchers may have the opportunity to derive more precise estimations and extend the model by adding further potentially relevant variables (Van den Bulte and Lilien 1997).

The selection of the case site represents a limitation inasmuch as the case municipality had already signaled interest in evaluating external M-Government services at the time the contact was established. Thus, a positive bias may be present. Regardless, the selected municipality represents as a critical case for our research since it was one of the first municipalities in Germany to embrace urban sensing within its municipal M-Government offering. Therefore we are confident that our research, including quantitative and qualitative case findings, will represent a valuable source of information for other municipalities that aim to advance in this field. One promising approach to achieve this, as we learned from our case, is to work with external parties and engage in public-private partnerships to operate such novel M-Government services. Future research should expand the focus of investigation to multiple case sites and investigate how implementation decisions and operating models of such services vary across different municipal contexts.

4.4.8 Summary

Involving citizen in public affairs through the use of participatory sensing applications is an emerging theme in mobile E-Government (M-Government). Prior work suggested that agencies place more emphasis on internal than on external M-Government projects.

This chapter took an action design research perspective to provide insight into the often overlooked potential of citizen-centric, external M-Government services. We considered the scenario of a sensing application for reporting urban infrastructure issues to the municipality and presented a System Dynamics model to estimate the diffusion, use, and municipal impacts of such service. The model was validated based on the case of a large German city, a dedicated survey and further data sources. The simulation results indicate that, compared to internal information acquisition procedures, the use of urban sensing can improve availability of environmental information at a comparable level of cost. Furthermore, we discussed a number of aspects and learnings related to an urban sensing implementation and provided an empirical estimation of the diffusion model. Our results provide an impetus for researchers and government practitioners to reconsider the benefits of urban sensing applications in E-Government endeavors.

5 Innovation Adoption and IT Governance in Enterprise Information Systems

5.1 The Impact of Software as a Service on Information Systems Authority

5.1.1 Preamble

This chapter has been initially published and presented at the 2011 International Conference on Information Systems (ICIS) in Shanghai, China (see Winkler, Goebel, Benlian, Bidault, and Günther 2011a).

5.1.2 Introduction

Software as a Service (SaaS) is changing the enterprise application landscape. In Central Europe, currently about 40 percent of companies use SaaS in at least one area of business applications (Benlian et al. 2009), in the US even more than 75 percent (Landmark 2011). Market researchers predict that in 2011, 25 percent of new business software purchases will be procured via SaaS and that this share will increase to approximately 34 percent by 2014 (Landmark 2011).

SaaS refers to applications delivered as services over the Internet and is commonly seen as the highest layer of the Cloud Computing stack (Armbrust et al. 2009). SaaS has evolved from earlier web-based deployment models such as application service providing (ASP) and is typically characterized by a highly scalable multi-tenant architecture on the provider side which allows for corresponding economies scale (Cusumano 2010). Compared to traditional on-premises installations, SaaS usage consequently leads to a reduction in a broad range of operational IT tasks in the user organization, such as infrastructure management, application management and application development (Lee et al. 2003).

Despite such reductions, however, there are a number of decisions and activities taking place at the interface between IT and the business, that clearly have to remain within the adopting organization. In this context, the concept of IT governance has received high attention as a major complementary resource to achieve IT performance through aligning business and IT (Brown and Magill 1994; Sambamurthy and Zmud 1999; Weill and Ross 2004a; Gu et al. 2008). An important part of IT governance is determined by the distribution of decision authority between the business and the IT function.

It is commonly recognized that there are three major archetypes of such governance arrangements: centralized, decentralized and federal modes (Brown and Magill 1994; Brown 1997; Sambamurthy and Zmud 1999). Thus, the overall question arises whether the deployment of SaaS and the reduction of original IT tasks also leads to a shift in the distribution of IS authority for SaaS applications?

Regarding this question, there exists some anecdotal evidence that with the advent of SaaS the business side takes over stronger IS authority for original IT activities, such as change management and application support (Yanosky 2008), which suggests a rather decentralized governance mode. Yet, other authors take the view, that the IT departments themselves will transform into a central mediator and integrator of external SaaS services in the long run (Gardner 2008), thus adopting (or preserving) a rather centralized SaaS governance mode.

While IS literature provides a considerable body of research that examines factors of SaaS adoption (e.g., Xin and Levina 2008; Benlian et al. 2009; Benlian and Hess 2010b; Benlian et al. 2010), few works have been devoted to explore the impact of SaaS adoption on internal IS governance and organization. Therefore, we aim to advance in this domain by formulating the following three research questions:

RQ1: *How do organizations allocate IS authority for SaaS applications?*

RQ2: *What are the factors that possibly influence this allocation?*

RQ3: *How* should *organizations allocate IS authority for SaaS applications?*

To address these questions, this works combines a contingency perspective (Gresov 1989) with a qualitative approach. Based on rich interview data, we apply Grounded Theory to extend an existing contingency model (Sambamurthy and Zmud 1999) by a set of factors for governance arrangements specifically on the application level. Further, we examine the explanatory power of these factors in four comparative cases of SaaS adoption.

Extrapolating the current trends in the SaaS market, our findings may help to better understand the long-term impacts of SaaS adoption on user organizations, which is of interest for an academic as well as a practitioner audience. The remainder of the chapter is structured as follows: In the next section (5.1.3) we review the theoretical foundations regarding SaaS adoption, IT governance and contingency theory. Then, in Section 5.1.4 we explain our research approach. Section 5.1.5 describes the derived contingency model, which is then applied in four comparative case studies (Section 5.1.6). Finally, Section 5.1.7 concludes by pointing out the limitations and future work.

5.1.3 Theoretical Foundations

In the following, we briefly review existing literature that informs the relationship between SaaS adoption and IS organization, and motivate why the concept of IT governance and a contingency approach are particularly suitable to further explore this relationship.

SaaS Adoption and IS Organization

Software as a Service (SaaS) commonly refers to a delivery model where standard software is hosted at an external provider and is used by multiple tenants over the Internet (Armbrust et al. 2009). It is contrary to traditional IT delivery where the software is typically either operated on the company's own computing infrastructure (on-premises) or hosted on dedicated instances at provider side (Lee et al. 2003). Thus, the distinguishing criterion between the two delivery models is the multi-tenancy capability of the software, rather than the question of internal or external delivery (Cusumano 2010). Economically, SaaS is often characterized by subscription-based pricing models, as opposed to perpetual-use licensing for on-premises software (e.g, Choudhary 2007a). However, empirical works show that in practice licensing models for SaaS are almost as diverse as for traditional software offerings (Lehmann et al. 2010).

Several works investigate the decision of firms for adopting SaaS-based enterprise software (e.g., Xin and Levina 2008; Benlian et al. 2009; 2010). These studies confirm that, inter alia, lower application specificity and smaller firm size are among the main drivers for SaaS deployment (Benlian et al. 2009), while security concerns represent a major barrier (Benlian et al. 2009; Benlian and Hess 2010b). Research on SaaS adoption mostly draws on Transaction Cost Theory (TCT) and the Resource Based View (RBV) as theoretical frameworks to explain the phenomenon (Xin and Levina 2008; Benlian et al. 2009). Apart from SaaS adoption, these theoretical frameworks may also provide appropriate constructs regarding the impact of SaaS on IS organization.

With respect to SaaS, TCT essentially states that companies will rather source software as a service if application specificity and uncertainty regarding the outsourcing provider is low. Application specificity in this context has been operationalized by other works as degrees of modularity, customization and integration into the application landscape (Benlian et al. 2009). Thus, from an organizational standpoint, TCT implies that the border of the IS organization using SaaS is defined by the overall degree to which SaaS-based sourcing is performed.

According to the RBV, only resources that are not source of a competitive advantage should be outsourced (Xin and Levina 2008). Resources in this sense may be physical, such as hardware or human capital, or intangible, such has processes, knowledge, or software. Thus, with regard to IS organization, RBV informs that resources related to SaaS-based sourcing remaining in-house, will be those that possess a high strategic value, such as certain knowledge or capabilities. In this context, absorptive capacities have been identified as an important organization-level construct explaining the capability of the employees to assimilate and make use of external information to the advantage of the firm (Cohen and Levinthal 1990; Roberts et al. 2011).

While providing important constructs to explain the border between the SaaS provider and the consumer organization, the theoretical frameworks presented hardly shed light on the internal borders, i.e. the arrangements between business and the internal IS organization. In this context, IT governance theory has emerged as an important concept.

IT Governance and Contingency Theory

IT governance is commonly understood as a subset of corporate governance that has evolved from IS strategy (Webb et al. 2006). The need for IT governance is motivated by Agency Theory (AT), which considers two or more actors (here: business and the IT organization) interacting in an asymmetric relationship. The business (principal) contracts the IT organization (agent) to implement and operate certain IT services. AT provides that certain governance mechanisms (norms) can be established to avoid opportunistic behavior of the agent and thus improve the effectiveness of this relationship.

One of these governance mechanisms refers to establishing the accountability framework. Sambamurthy and Zmud (1999) define this as *the patterns of authority for key IT activities*. These can be allocated either in a centralized or decentralized manner. In a corporate setting, centralization typically correlates with allocating decision rights to the IT department, while decentralization refers to the lines of business. Several approaches have been taken to operationalize IS authority (Brown and Magill 1994; Sambamurthy and Zmud 1999; Weill and Ross 2004a). Brown and Magill (1994) discuss the use of a 7-point versus a 5-point scale for assessing the locus of decision authorities. Weill and Ross (2004a) present a more sophisticated operationalization by six governance patters, which essentially combine the horizontal (i.e., business versus IT) with the vertical dimension (i.e., executive versus employee level). In addition, they define five decision domains (IT principles, IT architecture, IT infrastructure strategies, Business application needs, IT investment and prioritization) that these governance patters can be assigned to.

The distribution of IT decision rights has been found to be a major complementary organizational resource for achieving IT and firm performance (Weill and Ross 2004a; Gu et al. 2008). Yet, research shows that there is no single IT governance mode that fits all firms and domains of IT. Rather, the optimal governance mode is determined by a rich set of factors (Brown and Magill 1994; Sambamurthy and Zmud 1999). For example, in terms of IT infrastructure governance a more centralized mode should be adopted by firms with cost or revenue synergies while a more decentralized governance mode fits better to those firms that require local agility (Gu et al. 2008). Therefore a contingency approach appears also particularly useful to explain the mode of governance regarding the domain of SaaS applications.

Contingency theories originally stem from the field of organization theory. They represent a class of management research which recognizes that an organization needs to fit within its environment and context Fiedler and Others (1964). Thus, there are different decisions that are optimal depending on the salient forces in each of these situations. The theory of multiple contingencies for IT governance by Sambamurthy and Zmud (1999) is based on Gresov's (1989) conceptualization of fit and misfit in organizational design. It identifies a number of organizational-level contingencies for the overall IT governance mode which may also inform the question of the right mode of governance for SaaS applications.

5.1.4 Research Methodology

Data Acquisition

To explore the factors that determine SaaS authority on an application level, we followed a multiple case study approach and collected data from four companies using a SaaS. The replication logic of this study combined elements of a theoretical replication (i.e., selecting cases expected to yield in different results) with those of a literal replication strategy (i.e., cases producing similar results, see Yin 2003, pp. 46-53).

First, to ensure comparability of the cases and rule out influences presented by the type of application, we decided to focus on one popular SaaS application. We chose the customer relationship management (CRM) solution from Salesforce.com (SF), as CRM is among the most popular application types for SaaS (Benlian et al. 2009) and SF is one of the market leaders in this segment Landmark (2011). Then, potential case companies were drawn from a SF customer references site and contacted formally. In this selection we were seeking for differences in context variables such as industry and size to increase the generalizability (Yin 2003). Naturally, the selection also had to follow opportunistic criteria, as not all companies were willing to disclose information on their case. As we had found two cases for each manifestation of IS authority (allocation to the business, respectively to the IT side), we regarded the number of cases as sufficient to deepen into the analysis of contingent factors.

Interviews took place between May and July 2010 and followed a common semi-structured guideline with four main sections: a) introduction, b) company context, c) SaaS adoption, d) organizational impact (see Appendix 5). To identify peculiarities of SaaS usage, we replicated the questions in part c) and d) regarding an exemplary on-premises solution. In those companies that allocate SF authority mainly on the business side, we interviewed representatives from IT and the business. The overall 6 interviews amounted to more than 6 hours, respectively 67 pages of transcription which were subsequently reviewed by the interviewees. We complemented the interview material with company information from web resources and press clippings. The respective characteristics of the companies, SF usage and interviewee roles are listed in Table 5.1.

Data Analysis

We analyzed the interviews using grounded theory, a qualitative research method increasingly employed in IS studies (Matavire and Brown 2008). Grounded theory is contrary to other research methods as it systematically seeks to develop theory rather than verifying or testing it (Glaser and Strauss 1967). We opted for Glaserian grounded theory as it offers a more abstract conceptualization compared to the Straussian approach, which is thought of to be more prescriptive (van Niekerk and Roode 2009). Grounded theory originally postulates to conduct research without a priori knowledge. However, given the large theoretical body regarding our research, we took a more analytical approach which allowed us to integrate previous theories during the coding process. This is in line with

Table 5.1: Case companies and key figures

	Case A Education	**Case B** Manufacturing	**Case C** High-Tech	**Case D** Pharma
Revenue / Employees[a]	8 m EUR / 120	70 m EUR / 600	150 m EUR / 1,700	650 m EUR / 10,000
IT employees[a]	10	7	40	400
No. of SF CRM users[a]	30	60	150	860
Implementation time	n/a	1 week	3.5 months	9 months
IT interviewee	Head of IT (A)	IT Application Manager SAP (B_1)	Head of Competence Center CRM (C)	Application Manager (D_1)
Business interviewee	-	Sales Organizer and SF Key User (B_2)	-	CRM Associate Manager (D_2)

[a]Figures rounded for anonymity

the most common pattern of using grounded theory in the IS field (Matavire and Brown 2008).

We first analyzed the interview material by performing an open coding using an adapted Glaserian (1992) C-family paradigm with four main categories (context, contingency, covariance and consequences). The resulting 165 codes with total 507 quotations covered a calculatory 47% of the total interview material. As the core phenomenon, the arrangements for SaaS application governance, was clear from the beginning of the study, these text fragments could be directly assigned to the main categories in function of their relationship with the core phenomenon, see Figure 5.1.

As a second step in open coding, we aggregated these codes iteratively to appropriate mid-level concepts. Codes describing similar activities conducted by different actors (e.g., business or IT) were merged in this step. During this procedure, we also intensively drew on previous theoretical foundations and related work. For example, some categories describing the properties of the mentioned application emerged describing the *complexity to integrate* the SaaS application, the *ease to customize* it and required *training needs* during its introduction. Based on TCT and SaaS adoption literature, these three themes were clustered as proxies for overall *application specificity.* In the sense of a theoretical sampling (Glaser 1992), we also compared the variables of SaaS usage with those regarding typical on-premises applications.

Finally with regard to selective coding, we grouped these mid-level concepts around the core phenomenon and analyzed the type of relationships. Concepts that did not exhibit a logical link to the theme of application governance were discarded from the analysis, for example codes related to *costs* for SaaS/On-premise (31), *privacy and security concerns* (13) and properties of the *SaaS provider* (11). The resulting condensed

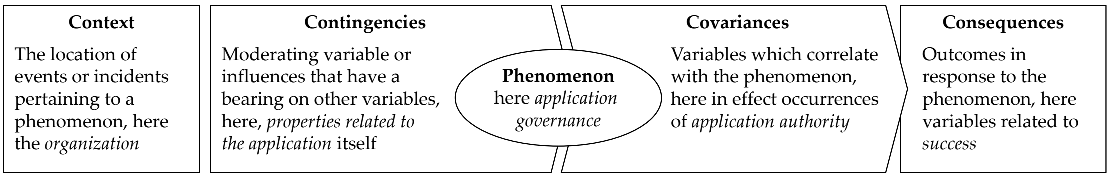


Figure 5.1: Adapted coding paradigm from Glaser (1992)

model comprises 17 variables related to application governance, 5 of which refer to the organization and 12 to the application level, see Figure 5.2.

Comparative Case Studies

After deriving the contingency model, we dimensionalized each of the variables on appropriate three-point scales (i.e., high, medium, low) to prepare the case comparison. For the variables of IS authority however, we chose a five-point scale as we perceive that the complex arrangements between business and IT need to be represented with sufficient detail (scale: business, business with IT involvement, Federal/Both, IT with business involvement, IT). Based on the relevant text passages, three authors separately assessed the 17 variables for each of the four cases in a comparative manner. The resulting inter-rater reliability of this assessment accounted for κ=0.35 measured by a weighted Cohen's kappa for ordinal measures, which can be regarded as a fair result (Landis and Koch 1977).

After the assessment, the authors discussed the contingency factors that were salient for each case. According to contingency theory (Gresov 1989; Sambamurthy and Zmud 1999), salient forces may either induce an IT- or business-oriented governance mode while weaker forces are not perceived to be decisive for determining the governance allocation. To validate our choice between salient and weaker forces, about half a year after the interviews, we made a second inquiry to the interviewees asking for the precise motivation for installing the respective governance mode. Finally, the case study findings presented here have been cross-checked with our interviewees and passed minor revisions.

5.1.5 Results – A Contingency Model for Application Governance

The derived model saturates the theoretical categories from Figure 1 with variables that describe governance for SaaS applications. Figure 2 depicts the model with code frequencies for each variable. In the following, we will illuminate these variables for each category highlighting theoretical and practical references as well as relevant quotations.

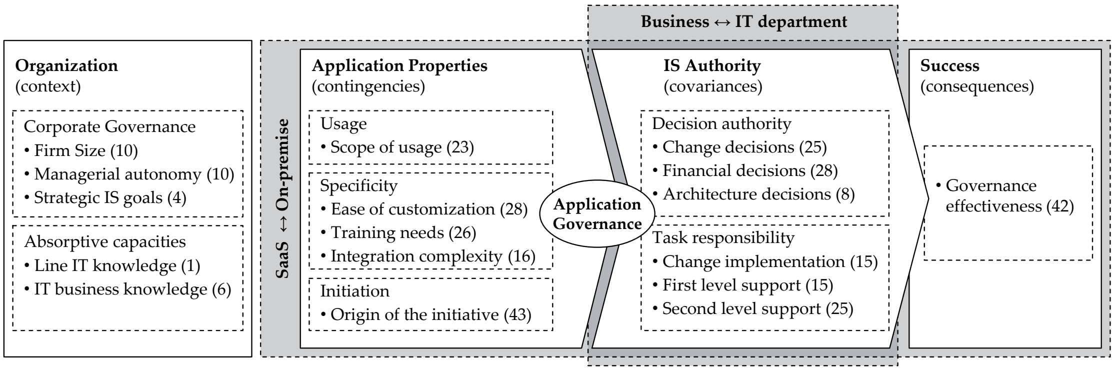


Figure 5.2: Contingency model for application governance (incl. code frequencies)

IS Authority

The variables defining *IS authority* are central to the phenomenon as they are expected to correlate with the actual mode of governance (i.e., centralized, federal, or decentralized), in other words they operationalize the concept of application governance. These variables refer to activities which are typically not outsourced (Lee et al. 2003), but remain within the company, either on business or IT side. Based on the common distinction between decision and execution, we divided this category into *decision authorities* and *task responsibilities*.

Decision Authorities The major decision areas regarding SaaS refer to application changes, financials and architecture, which is in line with the general domains for IT decisions (Weill and Ross 2004a) as well as with standard IT process models such as the IT Infrastructure Library (TSO 2011) .

Change decision authority refers to the responsibility of choosing which requirements should be implemented by the SaaS application. Such requirements typically refer to changes in data fields or workflows. ITIL suggests that such decisions are to be taken by a Change Advisory Board which represents a central governance body within the Change Management process (TSO 2011). One of our interviewees (A) states that for on-premise it is typically the IT role of the "Technical System Owner [who] initiates the change process", while regarding SaaS, in another case (D), there is an "Operational Committee [which] is made up of a representative from each of the business units and the groups in the business unit" to take such decisions, which shows the variance in this variable.

Financial decision authority is a central governance domain in any IT organization (Weill and Ross 2004a). Financial decisions regarding an application, such as annual spend for licenses and maintenance as well as singular investments and their prioritization, are usually taken by the organizational unit that owns the application budget. ITIL describes this decision domain in the Financial Management for IT Services process area

(TSO 2011). One participant (case A) emphasizes that SaaS usage leads to a "very high cost transparency to the business" while for in-house applications a number of "hard- and software, support-, upgrade, and backup-related costs accrue to IT costs" which are "not visible for the organization". Thus, even if the application budget is owned by a certain side of the organization (here IT), business may claim stronger decision authority for financial decisions regarding SaaS, compared to traditional on-premises applications.

Architecture decision authority deals with technical choices including data, technology, and applications to plot a path for migration and integration (Weill and Ross 2004a). Regarding a SaaS application, where most of data, technology and application logic is provided externally, this decision domain largely refers to questions of internet connectivity, security, and foremost integration with other applications. One interviewee (B_2) states that through the use of SaaS, fewer capabilities were required for technical integration on business side compared to on-premise applications "since we outsourced this to the SaaS provider". In contrast, for the on-premise solution, in this case Enterprise Resource Planning, it is always IT to "decide on integration" and "maintain the interfaces". For comprehensiveness, it may be noted that ITIL disregards architecture management as a dedicated process (TSO 2011).

Task Responsibilities Apart from decision authorities, there are a number of key operational activities regarding SaaS applications mainly referring to change management and end-user support. In some cases the SaaS provider carries out these tasks. However, the ultimate responsibility for these activities still needs to be allocated within the client organization.

Change implementation responsibility refers to the operational handling of changes, e.g. implementing customizations or new workflows and is defined in ITIL as part of the ITIL Change Management process (TSO 2011). Despite the multi-tenant design and an inherently high degree of standardization, SaaS applications typically offer the possibility to perform changes to the system in a web-based manner by authorized administrators (Sun et al. 2008). Thus, administrators may more likely be located in business. This is at least the case for interviewee D_2 who states: "I'm more part of the business, but I just manage Salesforce and [...] there are a lot of changes that we need to do". However, more common appears to be an allocation to IT as it is usually the case for traditional IT applications (Weill and Ross 2004a). Interviewee B_2 states: "I would be fine if I could implement minor customizations in the [on-premise ERP] without doing this with IT. This wouldn't be a disadvantage for the company". Finally, even if there are non-trivial changes to the SaaS system, the example demonstrates that this can be handled on the business side "by contracting an external partner [...] who worked without any involvement of the IT department".

Another important domain of IS authority on task level is the responsibility for end-user support (Brown and Magill 1994). We further differentiate between first and second level support. *First level support* refers to the responsibility to provide a central point of contact for users that have an issue with the respective SaaS application. Typical first level support activities include responding to user questions, or to grant access to a specific functionality. In ITIL, this corresponds to the Incident Management, Request Fulfillment and Access Management processes (TSO 2011). Interviewee C states that "the user sends a ticket to IT support which is routed to the respective Competence Center [...] and then we implement that and close the ticket". In Case D there are "three levels of support, first level which is myself [interviewee D_2] and the other system administrators and there's the second level which is basically IT", thus in this case tickets are first routed to support staff in business.

Second level support is understood as the responsibility for handling issues which cannot be resolved at first level. For a SaaS application, second level requests typically refer to any non-routine technical disturbance. This largely correlates with the Problem Management process defined in ITIL (TSO 2011). For SaaS, second level support may involve the IT department for example when "we have someone that can't access the system and on the [provider's] side everything looks absolutely fine." However, we recognize that for SaaS, internal IT may often be bypassed and problems are directed to the provider. Due to a higher degree of standardization, it is easier for the SaaS provider to support heterogeneous client organizations. Interviewee D_1 confirms that by stating "obviously with a SaaS solution, the vendor is much more aware of the integration aspect than he might be with a regular ERP [i.e. on-premises] solution".

Contingency Factors

In order to identify and structure the possible contingencies for the mode of SaaS governance, we distinguish between factors that refer to the organizational context of the firm, and such that relate to properties of the SaaS application itself. Since organization-level influences can be largely derived from IT governance theory (Sambamurthy and Zmud 1999; Weill and Ross 2004a), we did not focus on them during the interviews. This is also reflected in the low numbers of related quotations in the interviews (see Figure 5.2).

Organization-Level Contingencies Sambamurthy and Zmud (1999) define multiple contingent influences on overall IT governance, out of which two categories are found to be relevant for application governance as well: *corporate governance* and*absorptive capacities*. Regarding corporate governance, IT governance theory informs that *firm size* influences the mode of IT governance (Sambamurthy and Zmud 1999). Smaller firms tend to establish centralized IT departments to better coordinate the interdependencies between business functions. As firms grow, they develop more divisional structures, also calling for a more decentralized IS organization to maintain responsiveness to different lines-of-business (Ein-Dor and Segev 1982). We propose that such influence on IS governance will analogously apply to the narrower context of SaaS governance and include *firm size* into our model, i.e. larger firms will be more likely to allocate decision authority for SaaS applications to the business.

Following this argument, the general degree of *managerial autonomy* (Sambamurthy and Zmud 1999) of the firm is equally expected to explain the mode of SaaS governance. Suppose there are two firms of the same size, then rather the one where business-line managers have greater autonomy would also happen to decentralize IT governance for a SaaS application. Several studies emphasize that such correlation between overall firm governance and IT governance exists (e.g., Ein-Dor and Segev 1982; Brown and Magill 1994). Therefore we propose that *managerial autonomy* also influences in the allocation of SaaS authority.

As a third contingency in this category, we aggregate *strategic IS goals*. Strategic goals for the IS organization follow from business goals and have been conceptualized in different ways, e.g. as a trichotomy of IS efficiency, IS comprehensiveness and IS flexibility (Sabherwal and Chan 2001). Weill and Ross (2004a) demonstrate that companies defining low costs and standardized business processes as their IT principles would adopt a more centralized IS governance mode, while IS innovation- and growth-oriented companies rather install decentralized decision rights for the IS organization. Thus, we replicate this contingent influence to explain the mode of SaaS governance.

The second category on the organization level captures *absorptive capacities*. Absorptive capacities play an important role from a resource based perspective. Generally, they refer to the knowledge of a firm's employees that facilitates assimilation of external information and its application to desirable ends (Cohen and Levinthal 1990). Related to the question of SaaS governance, absorptive capacities may be particularly relevant regarding the *IT knowledge in business-line organizations* (Brown and Magill 1994; Bassellier et al. 2003). We propose that business managers and users who are knowledgeable about IT will also be more likely to take over decisions and activities for managing a SaaS application.

Conversely, absorptive capacities can also concern the *business knowledge within the IT department*. We find this particular theme of absorptive capacities largely underrepresented in IT governance research (Roberts et al. 2011). An exception may be seen in the work by Armstrong and Sambamurthy (1999) who analyze the influence of the CIO's business knowledge on IT assimilation. The more knowledgeable CIO and IT staff are about business processes, the more responsive may the IT organization react to business demands. Thus we propose that higher *business knowledge within the IT* department may also serve as an explanatory factor for a more centralized SaaS governance.

Application-Level Contingencies Based on the interview data, we contend that factors on organization level are not sufficient to explain the phenomenon of application governance for SaaS applications. Therefore, we extend the contingency theory on organization-level (Sambamurthy and Zmud 1999) by factors on application level and validate these in the light of related literature. These factors refer to the properties of the SaaS application itself and its implementation. They are divided in the categories *scope*, *application specificity*, and *initiative*.

The *scope of application usage* may depend on the type of application (Benlian et al. 2009). The SaaS CRM application subject to the investigation is typically used by employees in the marketing and sales departments, representing only a fraction of the firm. Interviewee A reports “the more departments use this application to manage data about potential customers, the more user requests come up and the more complex [the system] gets,” therefore, “a central process was required to control data quality”. Thus, if the application is used only by a few employees (e.g., for Engineering or Business Intelligence), it is more likely that these will also be more involved in decisions and activities. In contrast, a company-wide used SaaS application (e.g., for Office applications and Collaboration) would possibly induce a more central mode of application governance.

The following category, *application specificity*, stems from Transaction Cost Theory and has also been identified as one of the major (inverse) drivers of SaaS adoption (Benlian et al. 2009). We propose that specificity may also have a major influence on the induced mode of governance and conceptualize it by the three variables, *ease of customization, training needs* and*integration complexity.* Regarding the first, applications differ in their degree of customizability, i.e. the possibility to adapt user interface, data and processes to specific needs (Sun et al. 2008; Xin and Levina 2008). All interviewed subjects agree that SF CRM is “very easy to handle and fairly easy to implement” due to the fact that “everything is web-based” (here participant C). In contrast, to change something on the example on-premise application, interviewee B_2 reports, he “first need[s] to go to IT, then it will be changed in the test system, then it’s carried over to quality assurance and finally with the next release cycle it goes to the production system”, which makes the process clearly more time-consuming. Therefore we propose that a lower *ease of customization* may also explain the degree of IT staff involvement in SaaS-related decisions and activities.

The variable *training needs* reflects application specificity from the end user perspective. End user training has been commonly identified as a major success factor in software roll-out projects (Nah et al. 2001). Yet, with the increasing popularity of web-based applications such as SaaS, which satisfy new standards of software ergonomics, trainings needs might reduce. Interviewee B_1 states that trainings for introducing the SaaS solution “went faster, easier and it was less manpower needed than in other projects”. B_2 adds congruently from a business perspective that “[he] took over trainings for the colleagues of the foreign subsidiaries and did things, which were not in the job description of a salesperson”. Thus, we propose that lower *training needs* may be a motivation for stronger business involvement in application-related responsibilities and vice versa.

As a third proxy for application specificity we identified the *complexity to integrate* the SaaS application. There are different patterns for integrating a SaaS solution within the enterprise application landscape, e.g. for integrating user accounts, user interface, data and processes (Sun et al. 2007). Interviewee C reports that his company integrates the SaaS solution via a special buffering database which has been “programmed by the [ERP] team, and therefore they have quite some effort with this”. In contrast to this, company B uses “no bi-directional, but a one-way interface from [ERP] to SF CRM” so that internal IT says they have “almost nothing to do with running SF” (interviewee B_1). Thus, we propose that the degree of *integration complexity* of the SaaS application may help to explain how much central IT involvement is required in managing and deciding about that application.

Finally, another category emerged from the interviews capturing the *origin of the initiative*. IT projects such as introducing a SaaS application may be triggered from line organization or the IT department (Weill and Ross 2004a). Interviewee D states that "the business decided that they wanted to go with a hosted system" contrary to case C where the participant opposes "I think the last step came from IT to say, let's do it". The concept of project initiation is also used in other domains of IS literature, for example in green IT adoption (Zarnekow et al. 2010). As such motivation may also be sustained towards the later allocation of IS authority, we propose the *origin of the initiative* as the last factor to explain the mode of application governance.

Table 5.2: Contingency factors and proposed influence on application governance

Category	**Contingency factor**	**Induced mode of IS authority**		**Supporting literature**
		IT dept.	**Business org.**	
Organization level				
Corporate governance	1. Firm size	Small	Large	Ein-Dor and Segev 1982; Sambamurthy and Zmud 1999
	2. Managerial autonomy	Centralized	Decentralized	Ein-Dor and Segev 1982; Brown and Magill 1994
	3. Strategic IS goals	Efficiency	Growth	Sabherwal and Chan 2001; Weill and Ross 2004a
Absorptive capacities	4. Line IT knowledge	Low	High	Brown and Magill 1994; Bassellier et al. 2003
	5. IT business knowledge	High	Low	Armstrong and Sambamurthy 1999
Application level				
Scope	6. Application usage	Company-wide	Single unit	Benlian et al. 2009
Specificity	7. Integration complexity	High	Low	Sun et al. 2007; Benlian et al. 2009
	8. Ease of customization	Low	High	Sun et al. 2008; Xin and Levina 2008
	9. Training needs	High	Low	Nah et al. 2001
Initiative	10. Origin of initiative	IT dept.	Business org.	Weill and Ross 2004a; Zarnekow et al. 2010

Governance Effectiveness

Several consequences regarding the arrangements for application-level governance emerged from the data. Based on literature we reduced these to a single success variable reflecting different facets of the *governance effectiveness* for the SaaS application. The relatively high number of quotations of this concept (42) reflects a broad conceptualization as well as a high relevance of this variable.

One aspect of governance effectiveness refers to the alignment of business and IT (Brown and Magill 1994; Sabherwal and Chan 2001). For example, Interviewee D_2 states regarding the impact of SaaS: “I thought that there was quite a gap between business and IT rather than thinking we work the same company, [but] we’re all on the same side. And now [after implementing SaaS] business and the IT work together rather than it seems that one is holding over the other.” Another aspect refers to empowerment regarding the roles of business and IT, which results from an improved alignment. In the words of D_2: “I think that [the usage of SaaS] has empowered IT even more. It has given quite a positive outlook for IT from a business perspective.” Independently from this, the IT representative D_1 confirms from his perspective: “One clear thing is that by seeing [...] the SaaS solution, the business is more empowered to use and make sense with [the] application in what obviously the application allows. I think the SaaS application has empowered them to make the changes and give them more freedom.” So apparently in this case, the organization has found a governance arrangement that enables both sides, business and IT, to work together in a mutually satisfactory way.

Nevertheless, we contend that there are also more moderate examples regarding *governance effectiveness*. Regarding the interaction between business and IT, interviewee B_2 states soberly that “the only contact we have with IT is the interface from the [ERP] to SF”. Congruently, the representative from IT (B_1) does not perceive any improvement in the relationship neither in the role of IT nor of business. Quite the contrary, the interviewee negates any empowerment of the business side trough the usage of SaaS. We conclude that the satisfaction with the governance arrangements regarding the SaaS application can be regarded as rather moderate in this example.

Drawing on contingency theory, we propose that governance effectiveness describes a positive outcome if there is a fit between the SaaS governance arrangements, the organizational context and the properties of the SaaS application itself. Thus, it may be used as a criterion variable to evaluate the current mode of governance. The contingency factors, their operationalization and the possible influence on the mode of SaaS governance are summarized in Table 5.2.

5.1.6 Comparative Case Studies

In the following we will present the four cases of SaaS adoption and illustrate occurrences of contingent influences as well as the resulting mode of SaaS governance for each case. We focus on a brief description and outline the contingent forces that were salient in each case.

Case A: Private Educational Institution

The first case is a privately owned educational institution which offers executive and degree programs as well as consulting services to the industry. Central IT, a team of

10 people, understands itself as a service provider to the various business units that are subordinate to the management team. The strategic goals of IT in this institution are rather inclined to support growth and attract new students than to standardize business processes or save costs, which was also one of the motivations to introduce a CRM system.

SF CRM has been introduced in 2006 largely by the initiative of the former Head of IT. Since then it has been used by almost one fourth of staff in multiple business areas mostly for managing communication to clients, students and sponsors. Technically, it is operated as a stand-alone solution, yet a closer integration with the school's website is currently being considered. Due to the inherent properties of SF as an ergonomic and web-based product, ease of customization is considered to be quite high—a fact, which does not differ between the all the observed cases.

Regarding governance mode, SF fees are paid from IT budget, so that most of the application-related decisions are also ultimately taken by IT. Ideas for changes and customization of the system are often placed by business through a SF Business System Owner role. User support as well as most of the changes and customizations to the system are provided by the SF Technical System Owner, the counterpart IS role to the Business System Owner. Altogether, application governance in case A is quite IT centric, see Table 5.3. However, the initial case observation does not provide any indication, whether the chosen mode of SaaS governance is specifically effective or not.

Case B: Medium-sized Manufacturing Firm

Case company B is a medium-sized tool manufacturer with headquarters in Germany and a worldwide sales and distribution network. During the past years of economic crisis, IT budgets and workforce have been drastically cut, so that the remaining 7 IT employees serve almost 100 times more internal clients. One of the major motivations to install responsibility for the CRM system on business side was to disburden the IT organization. This efficiency-orientation is an overall pattern in the IS strategy.

SF CRM is used and governed within the marketing and sales department. It is integrated with the ERP system by a simple one-way interface, which is technically managed by central IT, yet creates few problems. The Sales Organizer and (only) SF Key User reports that his unit has been driving the CRM roll-out when it became clear that ERP- and spreadsheet-based customer databases just did not serve their purpose anymore. System customization, roll-out and training only took a minor time period.

Most SF-related decisions are now taken by the SF Key User himself, who also performs most changes and customizations to the system, and contracts external support if necessary. Yet, user issues regarding SF would first end up as usual incidents at the IT help desk, before eventually being routed to the key user for second level processing, see Table 5.3. The case analysis does not convey the impression that the installed governance mode has particularly contributed to the alignment or empowerment of business and IT (see preceding section).

Table 5.3: Case comparison and contingent forces

	Case A	**Case B**	**Case C**	**Case D**
Organization-level contingencies[a]				
1. Firm size	Small	Medium	Medium	**Large**
2. Managerial autonomy	Rather centralized	Rather centralized	Rather centralized	Rather decentralized
3. Strategic IS goals	Growth	**Efficiency**	Mixed	**Growth**
4. Line IT knowledge	Medium	Medium	Medium	**High**
5. IT business knowledge	Medium	Low	**High**	Medium
Application level contingencies[a]				
6. Scope of usage	Multiple Units	Single units	Single units	Single units
7. Integration complexity	Low (Stand-alone)	Medium (One-way)	High (Two-way)	High (Integration layer)
8. Ease of customization	High	High	High	High
9. Training needs	Low	Low	High	Med
10. Origin of initiative	**IT dept.**	**Business org.**	**IT dept.**	Business org.

[a] **Salient contingencies** in bold

Case C: Large High-Tech Company

The high-tech manufacturing and services company in case C operates in several European countries and has introduced SF CRM at first with 150 users in one pilot region. For this purpose, a dedicated Competence Center CRM has been created under IT leadership and hired high qualified staff, such as former consultants and university graduates, i.e. people with a comparably high level of absorptive capacities and business process knowledge.

Years before, several unsuccessful attempts to introduce CRM had been undertaken by the business line, until finally the topic was taken care of by central IT. According to the Head of the Competence Center CRM, there was a considerable effort during the roll-out for training users and convincing them of the benefits of such system. The fact of having capabilities on IT side to support the SF roll-out and consult the dispersed business organization was certainly a determining factor to also allocate the responsibility for the ongoing management of SF to this team.

The current governance structure for the CRM solution exhibits a comparably strong decision authority of the IT department, i.e. the CRM Competence Center team. Operational activities such as first and second level support, as well as change implementation are carried out by this team. Naturally, for main financial decisions, such as the budget process, as well as for decisions on change requests, business management and users are also strongly involved, see Table 5.3. The Head of Competence Center CRM reports on a clear appreciation of his team as a consultant and business enabler since implementing this specific SaaS CRM solution and the according governance model.

Case D: Global Pharma Services Company

Case D is a globally operating firm with five strategic business units (SBUs) according to different segments of services offered to the biotechnology and pharmaceutical sector. The use of information systems and management of large amounts e.g. of clinical data generally plays a crucial role in pharma services, therefore we classify IS goals as relatively innovation- and growth-oriented compared to the other cases.

This growth-orientation was also one of the major motivations to make a CRM tool available to the business. SF CRM has been introduced as a central solution displacing two prior systems of different SBUs in order to increase transparency across SBUs and leverage cross-sales potential. System introduction and customizing to the specific company requirements took overall about nine months. To manage SF, former CRM system administrators as well as qualified sales staff have been joined to form a new CRM administration team within the business organization. Given the large corporate setting, this relocation allowed to shift CRM authority from IT to business, while still allocating it to a centralized function within the organization.

This team is in charge of most decisions regarding SF, performs changes to the system and provides a single point of contact for SF user requests. If such a request cannot be resolved at the first level (ca. 40% of the cases), it will be passed to the IT application architecture team for second and third level processing. Furthermore, the SF solution is highly integrated with a number of systems (e.g., financial, costing, and clinical systems) via a special integration layer managed by IT. Consequently, architectural decisions and changes to the integration layer require high involvement of central IT, see Table 5.3. Both, business and IT representative share the view that through the new governance arrangements related to SaaS, overall IT alignment has improved and both parts of the organization are empowered to perform their new tasks regarding the application.

Case Comparison and Discussion

In the following we will compare the four cases of SaaS adoption, starting with the largest firm. We interpret the four cases by identifying patterns of reinforcing and conflicting contingencies (Gresov 1989; Sambamurthy and Zmud 1999). Therefore we first take a look at the salient contingencies, i.e. those that emerged as most determining forces in each case. According to contingency theory, multiple reinforcing forces, i.e. those influences which induce the same mode of application governance, would lead to a clear shape of IS authority (either centralized to IT or decentralized to business). In contrast,

Table 5.4: Comparison of induced and present governance mode

	Case A (Education)	**Case B** (Manufacturing)	**Case C** (High-Tech)	**Case D** (Pharma)
Induced gov. mode	IT with business	Federal (conflicting)	IT	Business
Present gov. mode	IT	Business	IT	Business
Governance effectiveness	Moderate	Moderate	High	High

multiple conflicting contingencies, i.e. those that induce a different outcome, would lead to a rather federal mode of application governance. Furthermore, we aggregate the present mode of application governance to a single variable (business, federal, IT). It is worth noting that there is clearly no case of a federal archetype for SaaS governance. Finally, we may compare this as-is characteristics as well as the theoretically induced mode of IT governance with the observed governance effectiveness for each case, see Table 4. The results of this comparison are discussed in the following.

For Case D (pharma), the results exhibit multiple reinforcing salient contingencies which clearly induce SaaS authority to be allocated in business. According to the presented contingency model, the comparably large *firm size* and rather growth-oriented *IS goals* are both indicative for a business-oriented mode of application governance. The fact that the company possesses comparably high *IT knowledge* within the SF administration team, which has been achieved by staffing people who eventually had worked in IT before, supports this perception. The present rather business-oriented governance mode exhibits a strong fit to these contingencies. This may justify the relatively high perceived governance effectiveness in this case.

For case C (high-tech), there are two reinforcing contingencies that militate in favor of allocating SaaS authority to IT. These contingencies are given by the comparably high *business knowledge of IT* staff and the fact that the *initiative* has been largely driven by the IT department. We assume that these dominant forces have overruled weaker influences such as *managerial autonomy* and *integration complexity*, thus leading to a present allocation of SaaS authority which is quite IT-centric. The fit between the present arrangement and the theoretically induced is in line with the satisfactory governance effectiveness we experienced in this case. However, in the response to our second inquiry, interviewee C stressed the current necessity to also “develop stronger key users in the regions and business units” and thus to permit more business-orientation even in the present governance mode.

In case B (manufacturing) we find a pair of apparently conflicting contingencies which refer to the *strategic IS focus* on efficiency on the one hand and the strong *initiative* of the business organization on the other. According to governance theory, such conflict induces a federal mode of IS authority (Sambamurthy and Zmud 1999), as a strategic focus on IS efficiency is generally not compatible with a decentralized governance mode

(Weill and Ross 2004a). However, we may also question the validity of the contingent influence of *strategic IS goals* on the SaaS governance. As SaaS applications are per se standardized and offer according economies of scale on the provider side, there are less reasons to centralize their governance as opposed to on-premises software. A statement by the business respresentative in case B underlines this: “We have to consider the tight personnel situation, existing positions have not been staffed [. . .], so that inevitably I have to take over things which are usually not part of my job description”. Thus, here our initial proposition regarding *strategic IS goals* fails to sufficiently explain the present mode of governance. Quite the contrary, efficiency-orientation may rather correlate with a more decentralized governance mode.

Case A (education) exhibits a single dominant contingency related to the *origin of the initiative* from IT. Thus, it is worth interpreting the weaker influences, even if they were not salient from the case. We found a number of contingencies primarily related to *application specificity* as well as rather growth-oriented IT goals speaking for a governance mode that involves more business into SaaS/SF-related decisions. However, we find a quite IS centric present mode of governance. According to contingency theory, the *effectiveness* of this arrangement could be increased if the fit to these contingencies was improved. In fact, this finding was supported by the interviewee’s response to our second inquiry. The Head of IT explains that “the solution has been introduced due to the strong engagement of the former Head of IT who did not foresee a proper handover to business”, a fact that he now considers as “a weakness in the overall roll-out procedure of the project”. Meanwhile, he has divided application authority into functional and technical responsibilities and passed large part of change decision and implementation responsibility to the department for corporate communications, i.e. the business organization.

5.1.7 Conclusion

In this chapter we investigated the impact of using Software as a Service (SaaS) on IT governance, defined as the locus of authority for key decisions and task responsibilities related to a SaaS application. Therefore we combined a contingency perspective with a multiple-case approach to explore the factors which influence the mode of SaaS governance. Based on the analysis of rich qualitative data and the review of existing theory, we derived a contingency model for governance arrangements on application level. Finally, we examined the explanatory power of this model in four comparative cases of SaaS adoption.

Findings and Contribution

The results show that for two companies (B, D) there are dominant or even reinforcing contingencies which induce the SaaS application to be governed by business side, while in the other two cases (A, C) there are contingencies that promote a rather IS-centric SaaS governance. Furthermore, we were able to provide narrative evidence that the prevailing governance mode for one case (A) resulted in a certain misfit of SaaS authority which had subsequently been rectified. Getting back to our research question how firms (should) allocate authority for SaaS applications, we contend that there is no appropriate governance form for all cases. The mode of SaaS governance rather depends on certain organizational and application-specific contingencies. In this context, *absorptive capacities* and the *origin of the initiative* have emerged as most determining forces in the four given cases, while a contingent influence of *strategic IS goals* could not be supported. Aligning the mode of governance with organization- and application-related contingencies is expected to positively affect success variables such as governance effectiveness.

Our contribution is threefold. First, we propose a number of factors that extend existing contingency theories (Sambamurthy and Zmud 1999) towards application-level governance. This appears particularly useful, as in today's networked organizations there is no rationale to establish the same governance mode across all business applications (Marks 2008). Second, we illustrate that the often claimed correlation of IS efficiency and a centralized authority does not necessarily hold for SaaS-based applications. This underlines the call for more research on the governance of cloud-based solutions. Finally, we propose a contingency model that can be used by both academics and practitioners to better understand the reasons why a certain mode of governance is chosen for a given SaaS application. We thereby hope to provide impetus and give directions for further research.

Limitations and Future Work

Due to the qualitative case study approach taken in this chapter, the obtained results may possess limited generalizability. However, the applied method allowed us to reveal important details about SaaS governance in the considered cases which was required from a theory generation and adaptation standpoint. Further, to ensure comparability of the cases, we only considered SaaS users of the application Salesforce CRM. Not surprisingly, this resulted in a low variance in some of the observed variables such as *application usage* and *specificity*. Also, we acknowledge a lack of the longitudinal dimension of the data. Focusing on a single point of time may limit the explanatory power of the derived contingency factors, as the narrative evidence regarding case A suggests. SaaS governance is a dynamic construct, so that future studies should consider a longer timeframe to address this issue. Methodologically, the contingency approach assumes exogenous factors and thus largely neglects possible interaction between governance arrangements and the organization. Conceivably, the chosen mode of governance may reversely affect certain organizational level variables such as absorptive capacities. Thus, other approaches such as process theories might seem more appropriate to capture these temporal interaction effects. Finally, given the qualitative nature of the criterion-variable we were unable make any safe assertion about the degree to which a certain misfit is good or bad (Umanath 2003). In a future work, we plan to conduct a large sample investigation with firms using different types of SaaS applications to validate our propositions and measure the effect of SaaS governance fit on appropriate criterion variables.

5.1.8 Summary

For some business applications, using Software as a Service (SaaS) is becoming increasingly popular. However, it is largely unknown how SaaS adoption affects the arrangements between business and IT departments. In this chapter, we took a contingency approach to investigate how firms allocate authority for SaaS applications. Based on semi-structured interviews with business and IT representatives of companies that have adopted the wide-spread SaaS solution Salesforce CRM, we extended existing contingency theory to propose a set of factors for governance arrangements on the application level. These factors are used in a comparative case study of 4 cases of SaaS adoption to explain why application authority is allocated either to the business or the IT side. The results suggest that in most cases there exist dominant and reinforcing contingencies determining a definite mode of SaaS governance.

5.2 Comparing Authority for On-Premises Applications and Software as a Service

5.2.1 Preamble

At the time of publishing this dissertation, this chapter represents a working paper which is currently under review for a major IS journal, see also (Winkler and Brown 2013a).

5.2.2 Introduction

Sharing information technology (IT) authority between business and IT departments and thus balancing the interests of different stakeholder groups is an ongoing issue in corporate management. Business units often claim higher authority over “their” share of the application landscape in order to fulfill their specific business needs, while central IT units typically need to cut down such initiatives and enforce corporate-wide standards in order to cope with scarce resources and successfully translate the corporate mission of economies of scale. The dilemma of balancing between economies of scale versus responsiveness has been widely recognized as a key challenge of IT governance (e.g., Tavakolian 1989; Brown and Magill 1994; Brown 1997; Sambamurthy and Zmud 1999; Weill and Ross 2004a), which is according to some authors “the single most important predictor of how much value firms derive form IT investments” (Weill and Ross 2004a). The allocation of IT decision rights has been investigated at the level of the overall IT function (Tavakolian 1989; Brown and Magill 1994; Brown 1997; Sambamurthy and Zmud 1999; Peterson et al. 2000; Weill and Ross 2004a), as well as for certain subdomains of IT governance, such as data governance (Khatri and Brown 2010), infrastructure governance (Gu et al. 2008; Xue et al. 2011) and governance in system development projects (Tiwana 2009). Few studies, however, have investigated internal governance arrangements between business and IT departments in an outsourcing context, e.g. when a third party is taking over IT service delivery for a specific business application.

One of the major trend shaping today’s software industry is the provisioning of enterprise applications and application components to multiple user organizations as a service over the Internet, i.e. Software as a service (SaaS). SaaS has evolved from earlier service delivery models and is now commonly regarded as the highest layer and most widely adopted form of cloud computing (Armbrust et al. 2009; Cusumano 2010). In contrast to traditional, on-premises installed software, SaaS applications are characterized by subscription-based pricing models (Choudhary 2007b), highly scalable multi-tenant architectures (Chong and Carraro 2006; Cusumano 2010), and web-based mass customization (Chong and Carraro 2006; Xin and Levina 2008). Previous studies on the SaaS model have examined adoption on the client side (Xin and Levina 2008; Benlian et al. 2009; Benlian and Hess 2010b), as well as governance issues between client and the provider, such as pricing (Choudhary 2007a), coordination Demirkan et al. (2010) and contractual arrangements (Susarla et al. 2009; 2010).

We argue that SaaS is also likely to defy the conventional rationales behind internal governance arrangements on the client side. That is, SaaS facilitates the deployment of new enterprise applications directly by business units. First, the reduction of up-front capital investment and implementation efforts for SaaS makes it easier for business units to fund and deploy required IT systems and thus circumvent centralized investment processes (Xin and Levina 2008; Xue et al. 2008). Second, through considering scalability requirements inherently in the software architecture, user-based customizations for SaaS can be performed largely without coding, either directly through the web interface or by deploying modular components (Sun et al. 2008; Xin and Levina 2008). This may drastically reduce the need of specialized IT capabilities for managing and maintaining these solutions on user side. Moreover, many SaaS solutions typically apply state-of-the-art techniques—also referred to as rich internet applications—in their web frontends, making them capable to replace an increasing number of centrally managed desktop solutions, such as collaboration and productivity applications Fraternali et al. (2010); Cusumano (2010). Some radical proponents even view SaaS as a manifestation of computing as a utility and thus prognosticate a general shift of IT authority from IT units to business departments Yanosky (2008) and consequently the disappearance of IT as a dedicated corporate function (Carr 2005). Some researchers, in contrast, provide exploratory case evidence that companies allocate the horizontal authority, i.e. the distribution of application related decision rights between business and IT units, for SaaS applications in different, but clearly distinguishable ways, dependent on certain organizational as well as application-specific contingencies by (Winkler et al. 2011a).

In this work, we build on the contingency model proposed by Winkler et al. (2011a) and adopt a multi-theoretic approach that combines agency theoretic, transaction cost theoretic, and knowledge based lenses to explain the horizontal distribution of IT authority on the application level. A research model is derived that conceptualizes relevant constructs for each of these theoretical perspectives. Thereby we aim to address the following research questions:

RQ1: *How can we explain the horizontal allocation of application authority in general?*

RQ2: *(How) does the allocation of authority differ between SaaS and on-premises applications?*

The research model was validated and tested in a survey with 207 large-sized companies, 76 of which provided information about an SaaS and 131 regarding an on-premise application in use. Our findings support the initial idea that application authority depends on certain organizational as well as application-specific contingencies. Furthermore, authority for SaaS-based applications is more frequently allocated to the business side and largely independent from overall IT governance arrangements. The chapter's central contribution is to demonstrate that it is useful to view IT governance as a symbiosis of modular arrangements on the application level in order to capture the changes induced by new technological architectures such as SaaS. For example, we demonstrate that for SaaS applications the business knowledge of IT staff plays a significantly more important role to retain authority in the IT department than for on-premises solutions. Our findings provide important implications from a theoretical and a practical standpoint.

The remainder of the chapter proceeds as follows. The next section describes the three theoretical lenses (5.2.3), followed by the research model and hypotheses (5.2.4), the research methodology (5.2.5), the statistical analysis (5.2.6), and a discussion of the results including theoretical and practical implications (5.2.7).

5.2.3 Three Theoretical Lenses on Application Authority

Agency-Theoretic View

Agency theory (AT) is concerned with problems that arise in asymmetric relationships where one party (the principal) delegates work to another (the agent) (Eisenhardt 1989a). Based on the behavioral assumptions of new institutional economics, i.e. self-interest, bounded rationality, and risk aversion (Williamson 2000), problems particularly occur when principal and agent possess conflicting goals, incomplete information and different risk preferences. Given a lack of information of the principal about the detailed activities of the agent, such incomplete contractual relationships can lead to a moral hazard of the agent to behave opportunistically, and thus cause suboptimal overall outcomes (Eisenhardt 1989a).

In terms of enterprise IT governance and the horizontal allocation of application authority, the business units of an organization can be understood as the principal who is engaged in a permanent contractual relationship with the IT unit (Posthumus and Solms 2008), that is, business units "delegate" IT delivery to IT units which are more specialized to perform this task. AT posits that certain mechanisms are required to prevent IT units from moral hazard, or, to put it more pragmatically, to deliver the expected value to business (Peterson et al. 2000; Weill and Ross 2004a). When IT authority is exclusively allocated to IT, there is a substantial threat that busines interests are not sufficiently considered, leading inter alia to a lack of business alignment (De Haes and Van Grembergen 2009; Tiwana and Konsynski 2010). Conversely, if IT authority is allocated to business units, considerations from a technical (e.g., integration with other IT solutions) as well as from an enterprise-wide perspective (e.g., the use of standards) are not sufficiently considered. Therefore, appropriate accountabilty schemes need to be established as a mechanism to overcome the problems posed in assymmetric relationships.

Modular systems theory suggests that the technological as well as organizational architecture of the IT function in the firm can be viewed as a bundle of more or less strongly interacting subsystems (Schilling 2000). Thus, there are likely to be business and IT actors (i.e., certain business departments and IT teams) who act as principals and agents in managing each respective enterprise application. AT suggests that application authority needs to be well defined and shared between these actors.

Transaction Cost Theoretic View

IS scholars have primarily drawn on transaction cost theory (TCT) to explain contractual arrangements and other governance phenomena in outsourcing relationships (see Nagpal 2004), including in an SaaS context (Susarla et al. 2009). TCT puts transactions, defined as the ultimate unit of economic activity (Commons 1931), and the cost for planning, adapting, and monitoring this activity, into the focus of interest to explain the boundary of an organization (or an organizational subunit) (Williamson 1985). Analogously, we apply this view to internal IT governance arrangements: Business departments enter into a contract with IT departments in order to handle application transactions efficiently—i.e. to economize on costs for planning, adapting, and monitoring application operation—or decide to coordinate application operations hierarchically.

TCT posits two important variables that determine transaction costs for managing applications. First, if the application is very *specific* to a business department and its processes, the transaction costs for 'contracting out' to the IT department increase, e.g. through higher efforts for communicating requirements, requesting system changes as well as for monitoring the IT unit's application operations (Susarla et al. 2010). Second, the costs for planning, adapting and monitoring application operation are subject to economies of scale with an increasing frequency of use. Thus, the relevant question from a TCT-perspective is which coordination form best leverages these relative cost advantages. Regarding intraorganizational arrangements, corporate units are inherently concerned with aggregating delivery for other business functions. Thus, in order to economize on transaction cost, frequently used applications are more efficiently managed by the corporate IT function. Altogether, TCT provides a framework for explaining horizontal allocations of authority by the specificity and usage characteristics of the respective application.

Knowledge based View

The knowledge-based theory (KBT) of the firm has evolved from the resource-based view and focuses on knowledge as the most unique and strategically important resource of the firm. (Grant 1996). The primary purpose of the firm is to integrate the specialized knowledge, which resides in the employees and is costly to transfer (Jensen and Meckling 1998). According to this view, centralized decision making is feasible, when knowledge resides in a single point in the organization, otherwise, bi- and multilateral decision making would be more suitable (Grant 1996).

For managing business applications, two complementing types of knowledge are most relevant: IT-related knowledge and knowledge of the business domain (Tiwana 2009). Due to the logic of specialized resources, the former, i.e. knowledge about technologies, applications and IT management, typically resides in the IT department, while the latter is inherently associated with business departments. Under this premise, KBT informs that joint decision making is required to facilitate effective decision making and, in case there is an overweight of any complementary knowledge on either side, this party is likely to have higher authority in for application-related issues. Thus, the knowledge-based view posits that horizontal authority for business applications is likely to be allocated towards the department where most pertinent knowledge is present (Jensen and Meckling 1998).

5.2.4 Research Model and Hypotheses

The research model depicted in Figure 5.3 follows from the agency-, transaction cost- and knowledge based theoretic considerations that help to explain horizontal application authority. In the following we conceptualize its constructs and develop underlying hypotheses regarding the potential difference between SaaS and on-premises applications.

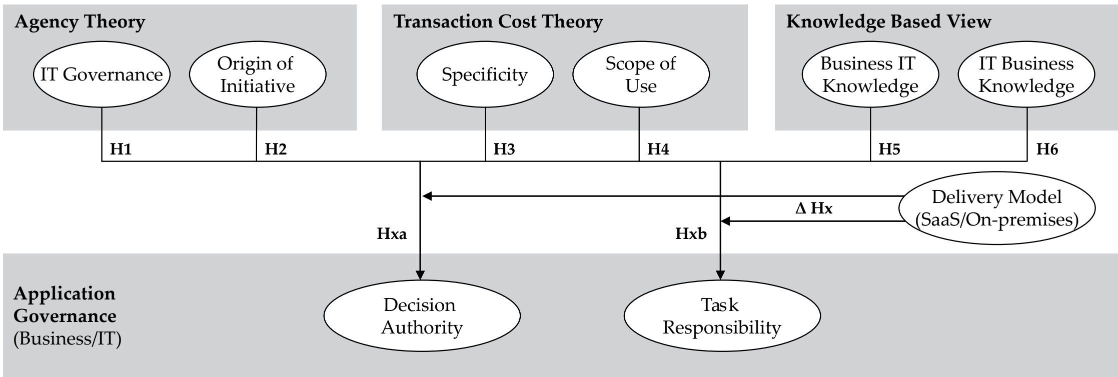


Figure 5.3: Research model

Application Governance

A business application—e.g. a system for enterprise resource planning (ERP), customer relationship management (CRM), business intelligence (BI), or collaboration and communication—can be regarded as an IT artifact that is a subset of the entire technological architecture of the IT function, runs on a corresponding infrastructure, and helps to deliver certain business functionalities (O'Brien 2005).

A business application—e.g., a system for enterprise resource planning (ERP), customer relationship management (CRM), business intelligence (BI), or collaboration and communication—can be regarded as an IT artifact that is a subset of the entire technological architecture of the IT function, runs on a corresponding infrastructure, and helps to deliver certain business functionalities (Fowler 2003; Orlikowski and Iacono 2001; Schilling 2000). Decision making regarding the overall IT function is regarded as core element of IT governance (Brown 1997; Sambamurthy and Zmud 1999; Weill and Ross 2004a). Prior researchers commonly emphasize the variability in the allocation of IT decision rights, which may be decentralized to business units or centralized to corporate IT units (Brown and Magill 1994; Brown 1997; Sambamurthy and Zmud 1999). Some later works also use a more sophisticated conceptualization by six governance patterns, which combine the horizontal (i.e., business versus IT) with the vertical distribution (i.e., executive versus employee level) (Weill and Ross 2004a). In this study, we focus on the horizontal dimension and the relationship between business and IT units, instead of stressing the common dichotomy of centralized and decentralized units, in order to delineate the concept of governance from questions of organizational structure.[1]

Depending on the domain of IT governance, there are different classes of decision rights. Prior research regarding governance in system development projects suggests to distiguish between two broad classes: decision control and decision management rights (Tiwana 2009). Applied to the context of application management, this implies that there are:

(1) Decision control rights which approve application related decisions, e.g. decisions on *which* functional changes or enhancements are to be implemented according to the business needs, decisions on investment for licenses and application maintenance as well as on general architectural choices. We may term this dimension of application governance as the general *decision authority* over an application.

(2) Decision management rights that implement application related decisions, e.g. decisions on *how to* implement functional or technical changes, decisions on how to support users and decisions how to solve application related problems. As these decision rights are directly associated with performing application related activities we may refer to this dimension as *task responsibility.*

The separation between decision control and decision management has been primarily motivated by agency theoretic considerations (Fama and Jensen 1983). That is, *application authority* and *task responsibility* should not be allocated to the same actor in order to establish effective control and prevent efficiency losses (Tiwana 2009). In a wider sense, the practitioner literature and common work practices widely recognize this principle as a “segregation of duties”. However, decision authorities and task responsibilitiesare are typically shared between business and IT roles: Decision authority for application investment could be allocated to a business unit head, decision authority for application changes to a business process owner, decision authority for architectural choices to the CIO, task responsibility for functional changes to a business analyst, and task responsibility for technical changes to an application expert. For this reason, some researchers have conceptualized IT governance as a continuum with greater or lesser ownership rather than a dichotomous allocation (Brown and Magill 1994; Gu et al. 2008; Tiwana 2009). According to this, in the aforementioned example we might find a greater decision authority from business side, and equal sharing of task responsibility between business and IT roles.

[1] While the dimensions decentralization/centralization and business/IT are certainly correlated, the former denotation may lack precision, since centralization may refer to various dimensions, e.g. lines of business, business functions, or geographies. Reversely, decisions may be allocated to IT and still be organizationally decentralized, for example if the IT organization itself is very decentralized (Brown 1999). For similar motivations, other authors have as well suggested to emancipate the concept of IT governance from organization structure (Sambamurthy and Zmud 2000).

Further, when an application is outsourced—as it is the case for SaaS—large parts of task responsibility are delegated to an external party. For example, a task structure proposed for SaaS CRM services consists of seven tasks, out of which only two (mapping SaaS to business requirements, streamlining customer-facing activities) are performed by the user organization (Susarla et al. 2010). However, the client organization still needs to retain, or even build up, certain capabilities to coordinate and control the activities of the external provider (Willcocks et al. 2006). Thus, from a agency theoretic perspective, we may say that outsourcing "converts" internal decision management rights into according decision control rights over external tasks. Nevertheless, the ultimate locus of responsibility for the provider's tasks still remains within the client organization. Therefore, in our conceptualization we include the notion of controlling external tasks within the concept of task responsibility and limit this dimension to the continuum between business and (internal) IT departments.

Especially for SaaS-based sourcing, where costs are more transparent compared to complex IT investment and accounting schemes (Choudhary 2007a; Xue et al. 2008), business units may claim more decision authority over application related issues. As stated earlier, some tasks, which would traditionally require technical IT capabilities, such as performing small changes to an application, e.g. implementing a new workflow, might shift to the responsibility of business users, since SaaS solution are inherently designed for user based customization (Sun et al. 2008; Xin and Levina 2008). Accordingly, we pose our principal differential hypothesis that motivates research:

ΔH0: *In a sample of pairs of organizations and business applications, the horizontal allocation of decision authority (ΔH0a) and task responsibility (ΔH0b) will differ between applications with SaaS and on-premises delivery models.*

IT Governance (organization level)

Having stated that applications are a subset of the technical IT architecture, and application governance arrangements are a subset of overall governance arrangements, these arrangements on application level are likely to be dependent on the overall IT governance framework (Schilling 2000; Tiwana and Konsynski 2010). Congruently with the application governance dimensions, we focus on the horizontal allocation of overall application related decision rights between business and IT units and delieate from the centralizatoin/decentralization dichotomy. Different domains of overall IT decision rights have been proposed by the literature, for example a widely recognized framework of five IT domains: IT principles, IT infrastructure strategies, business application needs, IT investment and prioritization, IT architecture (Weill and Ross 2004a). Arguably, the last three of these categories are more likely to influence individual governance arrangements on the application level, while the other two (IT principles and IT infrastructure) are only indirectly linked with application-related decision making. For example, IT infrastructure is frequently governed in a centralized mode while application-related decision making is more shared between business and (decentralized) IT units—a pattern that has also been recognized as a federal (or hybrid) archetype (Brown 1999; 1997; Sambamurthy and Zmud 1999). Thus, for the purpose of this study we define IT governance more narrowly as the horizontal distribution of IT decision rights on the organization level between business and IT units regarding business application needs, IT investment, and IT architecture. We may hypothesize

H1: *Overall IT governance is positively associated with application level decision authority (H1a) and task responsibility (H1b).*

In this research we conjecture that SaaS and related delivery models, which exhibit scalable outsourcing possibilities, are likely to unleash a new dynamism in IT organization and governance phenomena (Peak and Azadmanesh 1997; Winkler et al. 2011a). Thus, given that the use of SaaS applications in business organizations today still represents a small fraction of the overall technological architecture (i.e., the entire application landscape), we expect the arrangements for governing SaaS applications to deviate notably from overall governance arrangements. That is, overall IT governance arrangements are likely to influence traditional on-premise application governance, however to a lesser extent SaaS application governance. Accordingly we hypothesize

ΔH1: *The association of overall IT governance with application governance (ΔH1a/b) is weaker for SaaS than for on-premises applications, i.e. the type of delivery model (SaaS/On-premise) moderates the relationship between IT governance and application governance.*

Origin of Initiative (application level)

Explorative case findings on application governance suggest that especially in SaaS contexts the *origin of the initiative* to introduce a new application—i.e. the question whether it is started out of the business unit or the IT department—is a strong predictor for the resulting application governance mode (Winkler et al. 2011a). In a procedural view, the locus of initiative may be regarded as the exertion of a specific decision right that is applicable during the first step in decision making (Fama and Jensen 1983). However, we delineate initiative from decision rights by two criteria that refer to time and voluntariness. During the pre-decision phase of an implementation project, parties giving input to investment decisions may be very distinct from those approving a decision (Xue et al. 2008). That is, project ideas can be brought in by business *or* IT stakeholders, while the roles for deciding on and executing them may be more firmly defined. Still, depending on the degrees of freedom in defining these later roles, we hypothesize a path dependency between the initiation and later application governance outcomes, since the initiator may inherently have a higher interest in taking over later decision rights (Fama and Jensen 1983). Accordingly we pose

H2: *The locus of initiative is positively associated with application decision authority (H2a) and task responsibility (H2b).*

Initiating the implementation of an application may as well be thought of as an act of applying particular knowledge towards a desirable outcome (Jensen 1998). As argued earlier, SaaS applications may require less technical knowledge than traditional, on-premises applications for implementing them. For example, potential initiators may assess the possibilites of application usage more easily by using online easier trial versions, which are commonly available for SaaS (Gallaugher and Wang 2002). This way, potential initiators can better educate themselves about functional as well as technical features and thus inform their initiation decision, as opposed to on-premises software that typically requires a local installation before testing. Accordingly we pose that

ΔH2: *The association of application initiative with application governance (ΔH2a/b) is stronger for SaaS than for on-premises applications, i.e. the type of delivery model (SaaS/On-premise) moderates the relationship between initiative and application governance.*

Specificity (application level)

In line with TCT, application specificity is likely to affect application governance outcomes. In the outsourcing literature, application specificity has been conceptualized as the degree to which an application is customized prior to its implementation in an organization (Benlian et al. 2009). Consider the example an application for business intelligence, which is inherently specific to a business, since the information provided (e.g., via dashboards and data cubes) needs to be individually adapted to the company's business context (Essaidi 2010). Thus, operating this application requires—besides IT roles—many business users of different management levels. In contrast, applications e.g. for communicating and collaborating (e.g., email, conferencing and word processing), reasonably require less business involvement (Cusumano 2010). Accordingly we pose

H3: *Application specificity is positively (negatively) associated with application decision authority (H3a) and task responsibility (H3b) from business side (IT side).*

There are grounds to assume that SaaS applications facilitate easier customization and integration compared to the bulk of on-premises installed software. That is, SaaS offerings try to avoid tenant-based customizations in terms of code changes at all cost by providing a broad set of configuration options that are easily accessible to the user, e.g. to add data fields, set up reports, define business rules, create workflows, etc. (Sun et al. 2008). Thus, even highly specific business applications are more likely to be governed and maintained directly by business units. For comparison, we may think of the complex parameter sets, configuration tables and custom written code in conventional on-premise ERP systems (Dittrich et al. 2009), which necessitate an involvement of an IT specialist even to implement small changes to the application. Accordingly we pose that

ΔH3: *The association of application specificity with application governance (ΔH3a/b) is stronger for SaaS than for on-premises applications, i.e. the type of delivery model (SaaS/On-premise) moderates the relationship between specificity and application governance.*

Scope of Use (application level)

Scope of application use relates to the frequency construct in TCT. Plausibly, the frequency of transactions with an application is directly determined by the number of users and business departments making use of this specific application. Different types of business applications may vary strongly in the scope of use. A business intelligence solution will typically have few expert users residing in management positions or staff functions (Essaidi 2010), while mentioned collaboration and communication tools may be used across the entire organization.[2]. Based on the rationale of scale effects in the cost for controlling and managing firm-wide applications (Nagpal 2004), these are more likely to be governed in a centralized, IT dominated fashion, compared to smaller applications which may be more dispersed over the organization. Accordingly we pose that

H4: *The scope of use of an application is positively (negatively) associated with application decision authority (H4a) and task responsibility (H4b) from IT side (business side).*

Based on the technological differences outlined earlier, the dispersion of application governance across an organization may be facilitated by component based delivery models such as SaaS (Tiwana and Konsynski 2010). Arguing in a transaction cost theoretic way, the paradigm of centralizing application authority in order to leverage internal economies of scale may become much weaker for SaaS, since cost advantages refer only to coordination costs, not to production costs (since the latter rather accrue externally on provider side, (Armbrust et al. 2009). This implies that with SaaS, there is a lower incentive to allocate governance to a central IT department if the scope of use is medium or low. Thus, the scope of use becomes more a decisive criterion in the allocation of SaS governance, compared to on-premises models. In other words

ΔH4: *The association of the scope of use with application governance (ΔH4a/b) is stronger for SaaS than for on-premises applications, i.e. the type of delivery model (SaaS/On-premise) moderates the relationship between scope and application governance.*

Business IT Knowledge (organization level)

Drawing on the knowledge based view, complementary knowledge on business side is likely to affect application governance arrangements. That is, the more technical and IT-related knowledge business managers and employees have collectively ‘absorbed’, the more inclined they will be to take over authority in application related decision making and operational IT tasks (Sambamurthy and Zmud 1999). According to a range of IS studies, IT knowlede can derive either from internalization of external knowledge e.g. on IT management practices, applications and technologies, or from prior experience, for example from participation in IT projects (Bassellier et al. 2003). Managers and employees then build a capacity to apply this knowledge to achieve individually desirable outcomes (e.g., for automating personal work routines, or organizing data). This in turn

[2]This does not imply that specificity and scope are necessarily correlated. For example, ERP systems are frequently used throughout many departments of a firm and still highly customized (Dittrich et al. 2009)

may lead them to seek higher involvement in decisions related to other applications (Sambamurthy and Zmud 1999). Accordingly we pose that

H5: *The business' IT knowledge is positively (negatively) associated with greater application decision authority (H5a) and task responsibility (H5b) by business units (IT units).*

For mass delivery models like SaaS, where most detailed technical and implementation related decisions are in the hands of an external party (Sun et al. 2008), the need for distinctive IT knowledge for making IT governance decisions may diminish. That is, business managers and IT employees do not require more than basic IT knowledge in order to make informed decisions regarding SaaS (Yanosky 2008). This proposition fits to the opposite observation that in custom software development projects, i.e. for comparably complex on-premise software delivery contexts, the client departments' technical knowledge is an important prequisite to reap the benefits from decentralized decision rights (Tiwana 2009). Thus, for on-premise software delivery, higher IT knowledge of business users appears as a precondition to decentralize governance as opposed to SaaS. Conversely:

ΔH5: *The association of IT knowledge in business units with application governance (ΔH5a/b) is weaker for SaaS than for on-premises applications, i.e. the type of delivery model (SaaS/On-premise) moderates the relationship between business IT knowledge and application governance.*

IT Business Knowledge (organization level)

Complementary knowledge on the IT side refers to the IT employees' collective knowledge of the business domain (Tiwana 2009). The earlier IT governance literature has rarely discussed the relevance of absorptive capacities and knowledge on IT side (Brown and Magill 1994; Sambamurthy and Zmud 1999). However, according to the knowledge based view, business-knowledgeable IT employees are more likely to take over application authority, potentially also for required business decisions that arise during the lifecycle of an application. Business knowledge of IT professionals can be broadly conceptualized as organization-specific and interpersonal/management competence (Bassellier and Benbasat 2004). We focus on the first component and conceptualize *IT business knowledge* as the insight into the business processes and day to day activities, since business applications primarily support these procedural aspects of an organization (Davenport and Short 2003). IT emplyoyees who have high knowledge of the business core processes—for example, from working previously in a business role—are evidently more educated to make decisions on the *what* to implement to an application, when introducing, operating and enhancing it. Accordingly we pose that

H6: *The IT's business knowledge is positively (negatively) associated with greater application decision authority (H6a) and task responsibility (H6b) by IT units (business units).*

The emergence of delivery models such as SaaS may demand different skill requirements for IT employees (Bassellier and Benbasat 2004; Roepke et al. 2000). Since technical tasks are largely performed externally, the profile of an IT team managing SaaS may resemble more a consultant to the business and a service integrator (Yanosky 2008). For example, in one of the cases explored in (Winkler et al. 2011a), the central IT department hired a team of experienced business consultants to govern and manage the externally provided SaaS CRM solution. This is congruent with other researchers who have emphasized the need for client-specific knowledge on the IT provider side (Susarla et al. 2010). Conversely, if internal IT does not provide the skills and insights in the business processes and day to day operations, there is greater motivation for business units to take over authority for SaaS based applications. Accordingly we pose

ΔH6: *The association of business knowledge in IT units with application governance (ΔH6a/b) is stronger for SaaS than for on-premises applications, i.e. the type of delivery model (SaaS/On-premise) moderates the relationship between IT business knowledge and application governance.*

Table 5.5 presents an overview of all constructs with their theoretical framework, our definition, the hypothesized impact on application governance and supporting literature.

Control Variables

To account for the differences among organizations, we include four control variables in our research model which are commonly discussed in IT adoption and governance contexts. These variables relate to industry, overall firm size, relative IT organization size and time since implementation of the application. As we aim to demonstrate generalizable results, we expect these variables *not* to be associated with the dependent variables of application governance, i.e. to find them outside of our theoretical framework.

Industry Earlier research on organization and governance phenomena was unable to find a significant and assocication between a corporation's industry and the level of decentralization of IT in the organization (Brown and Grant 2005). We control for the industry dimension by differentiating between manufacturing firms (selling physical products) and service firms (selling informational products, respectively services). Since there are possibly mixed forms of service and manufacturing businesses (for example manufacturing companies that generate significant revenues with post-sales services), we operationalize this control variable as a bipolar scale.

Firm Size The influence of firm size on IT governance arrangements has been viewed ambiguously in the literature. While a number of earlier studies could not show a significant relationship of firm size and the adoption of a particular IT governance pattern (Brown and Grant 2005; Tavakolian 1989), later studies have substantiated such relationship due to an increased need for coordinating mechanisms in complex organizational structures (Brown and Magill 1994; Sambamurthy and Zmud 2000; Weill and Ross 2004a). We assume that the firm size will be largely reflected in the mode

Table 5.5: Hypotheses overview

H	Construct	Level	Lens[a]	Definiton	Dimension	Association with application governance		Difference SaaS/On-premises	
0a	Decision Authority	App.	AT	Locus of application related control decisions rights	Bus./ IT	Dependent variable	Tiwana 2009; Fama and Jensen 1983; Schilling 2000; Susarla et al. 2010	SaaS → Bus OnPr → IT	Susarla et al. 2010; Choudhary 2007a; Xin and Levina 2008; Sun et al. 2008
0b	Task Respon-sibility	App.	AT	Locus of application related decision management rights	Bus./ IT	Dependent variable		SaaS → Bus OnPr → IT	
1	IT Governance	Org.	AT	Locus of application related decision rights on the function level	Bus./ IT	Bus. → Bus. IT → IT	Brown and Magill 1994; Brown 1997; Sambamurthy and Zmud 1999; Weill and Ross 2004a	SaaS: weak OnPr: strong	Peak and Azadmanesh 1997; Tiwana 2009; Winkler et al. 2011a
2	Origin of Initiative	App.	AT, KBV	Locus of origin of the idea to introduce the application	Bus./ IT	Bus. → Bus. IT → IT	Fama and Jensen 1983; Winkler et al. 2011a; Xue et al. 2008	SaaS: strong OnPr: weak	Gallaugher and Wang 2002; Jensen 1998; Winkler et al. 2011a
3	Specificity	App.	TCT	Degree to which the application has been customized to the companies processes	Low/ high	High → Bus. Low → IT	Benlian et al. 2009; Dittrich et al. 2009; Sun et al. 2008; Susarla et al. 2009	SaaS: strong OnPr: weak	Essaidi 2010; Sun et al. 2008; Xin and Levina 2008
4	Scope of Use	App.	TCT	Share of employees and departments making use of the application	Low/ high	High → IT Low → Bus.	Nagpal 2004	SaaS: strong OnPr: weak	Tiwana and Konsynski 2010; Winkler et al. 2011a
5	Business IT knowledge	Org.	KBV	Amount of complementary knowledge on business side	Low/ high	High → Bus. Low → IT	Sambamurthy and Zmud 1999; Bassellier et al. 2003	SaaS: weak OnPr: strong	Sun et al. 2008; Tiwana 2009; Yanosky 2008
6	IT business knowledge	Org.	KBV	Amount of complementary knowledge on IT side	Low/ high	High → IT Low → Bus.	Tiwana 2009; Bassellier and Benbasat 2004	SaaS: strong OnPr: weak	Roepke et al. 2000; Willcocks et al. 2006; Winkler et al. 2011a

[a] Theoretical lenses: AT: Agency theory, TCT: Transaction cost theory, KBV: Knowledge based view

of overall IT governance, rather than having a distiguishable impact on the appication governance variables and control for this influence.

IT Organization Size Investigating a phenomenon that affects internal business and IT organization, it stands to reason that we also consider the size of the internal IT organization as a separate control variable. Since absolute size of the IT organization is directly dependent on the overall firm size, we operationalize this parameter as the *relative* size (i.e., IT employees by total employees of the firm). Connecting this variable to our theoretical framework implies the question, whether governance (i.e., the distribution of decision rights) and organization (i.e., the distribution of resources) can be regarded as independent phenomena, or need to viewed endogenously correlated (Sambamurthy and Zmud 2000).

Time We include the time since implementation of the application as an additional control variable. IT governance is comonly viewed as a rather static concept that needs to be well designed and implemented in an organization via certain mechanisms (Weill and Ross 2004a). This contrasts with the dynamic development of organizations. It is plausible that governance arrangements that have been made at the time of implementing an application, do not fit to the more recent conditions (i.e., at the time a survey is taken), since organizations may walk through a learning process by using an application (Liang et al. 2007). Thus, in some cases governance arrangements need to be subsequently adjusted, in some cases for example by formally assigning more authority to key business users (Winkler et al. 2011a). The time variable controls for the distorting effect of time in post-implementation developments (Liang et al. 2007).

5.2.5 Methodology

We operationalized the proposed research model in a multi-step procedure conducted a survey with IT decision makers in 207 large-sized firms to test our hypotheses.

Construct Operationalization and Scale Development

Our research model is based on the explorative case studies and variables identified in (Winkler et al. 2011a). Relevant construct items were drawn from literature where possible, i.e. for IT governance (Weill and Ross 2004a), business IT knowledge (Bassellier et al. 2003), and specificity (Benlian et al. 2009), or derived from the case material where necessary (i.e., for decision authority, task responsibility, initiative, IT business knowledge, and scope of use). For appropriate semantic granularity, business/IT dimensions were operationalized on five-point scales (busines; business with IT involvement; business and IT equally, IT with business involvement; central IT) (Brown and Magill 1994), and high/low dimensions via seven-point scales. In line with the extant literature, the IT governance construct was operationalized by formative items, i.e. three classes of major decision domains that mutually define an overall mode of IT governance (Weill and Ross 2004a). All remaining constructs are operationalized by reflective items, i.e. the items are assumed to reflect the true value of the latent variable.

Several steps were taken to refine these measures as well as to assure reliability and validity. During this process, each construct was reduced to 2-3 items (2 for seven-point and 3 for five-point scaled items). The survey addressed high ranking managers and ought to include more questions from a global survey related to this project, thus limiting total questionnaire lenth and reducing redundancy was a major goal in this procedure. In a first step, a category sorting was performed with 8 fellow researchers, i.e. the items were shuffled and had to be sorted according to the definitions of the constructs. Second, an online pretest was conducted with 29 IT professionals from industry and consulting as well as experienced researchers, who were requested to fill the core questionnaire for a company and two applications (SaaS and On-premise) of their choice. The pretest yielded in acceptable reliability values (alpha>0.8) for all items and constructs considered in this research except one (specificity), whose items were subsequently rephrased. The entire final questionnaire was pretested in paper-based form by thinkaloud meetings with 3 different CIOs and only passed minor revisions regarding understandability and layout.

Data Acquisition and Sample Characteristics

We retrieved the addresses of Germany based firms with more that 50 million Euro of revenues and more than 500 employees (excluding public sector) from a commercial publisher of company information. The focus on large companies is motivated by the assumption that we find a stronger variance in business/IT governance arrangemens—as well as a higher sensitivity for this topic—in large firms with higher coordination needs (Weill and Ross 2004a). In April 2011, formal invitations were sent out to 2,886 companies including a paper version of the questionnaire, a return envelope, and cover letter including references to the project website as well as the online questionnaire. As an incentive, we offered a small gadget for the first 100 respondents as well as the chance to win a tablet computer for all participants. After a six-week response period and combined phone/email reminders, we received a feedback from total 534 companies, out of whom 220 provided usable responses (60% online, 40% paper-based). We attribute this moderate response rate (7.6%) to the total questionnaire length as well as to the increasing saturation of IT decision makers with research inquiries, a fact which was also stated in some of the reminder calls. Further 13 records were removed due to missing or inconsistent values in the questions regarding our research model. Cover letter and the complete questionnaire in German language, including the items for this study, are presented in Appendices 6.1 and 6.2.

Respondents stated to be top-level information officers (20%), senior IT managers (47%), IT managers (20%), IT staff (3%), as well as business managers (3%), senior business managers (3%) and CEOs (4%) with a median of 11.5 years of work experience. Textual job descriptions revealed that respondents with business roles were chief operating officers (COOs), business unit IT managers, or in similar positions with

Table 5.6: Application types and sample distribution

Application types	**All**	**SaaS**	**On-Prem**	**Application types**	**All**	**SaaS**	**On-Prem**
Business Intelligence & Analytics	7%	8%	6%	Office & Productivity	5%	7%	5%
Communications & Collaboration	7%	16%	2%	Production Execution	4%	5%	3%
Customer Relationship Mgmt. (CRM)	8%	13%	6%	Service Management	2%	4%	1%
Engineering & Design	0%	0%	1%	Supply Chain Mgmt. (SCM)	3%	8%	1%
Enterprise Resource Planning (ERP)	48%	17%	66%	Other	11%	16%	8%
Human Resource Management (HRM)	3%	7%	2%	*Total*	*207 100%*	*76 100%*	*131 100%*

IT responsibility, therefore we decided not to remove these records from the sample.[3] The industry distribution (based on the German industry classification code) does not reveal a significant bias compared to the distribution of invited companies. The size distribution (measured by number of employees) indicates that larger firms responded overproportionally to our inquiry. The mean number of employees is 4,780 (quartiles: 700; 1,300; 2,500; skewness: 6.7) and mean number of IT employees is 130 (quartiles: 7; 15; 35; skewness: 11.2). The data selection procedures and sample description is reported more extensively in Appendix apx:bitdata.

After completing the questionnaire section on overall IT organization, participants were asked to provide information about an SaaS or an on-premise application of their choice that is relevant to their business and that they are knowledgeable about. For the purpose of distinction, SaaS had been defined as "*any enterprise software that is deployed over the internet by an external provider and is accessed by users at different companies through the web browser",* while an on-premises application was described as *"any enterprise software that is installed in a traditional way and run on computers belonging to the 'premises' of your company, i.e. this installation is only used by your company".* Out of 207 respondents, 76 provided information about an SaaS and 131 regarding an on-premises solution. The underlying distribution of between SaaS and on-premises according to a classification into common application types is presented in Table 5.6.

[3] T-tests demonstrated no significant subgroup differences in the model variables for business and IT respondents, except for the indicators Spec1 and DecAuth2. As a robustness check, we also recalculated the PLS model excluding respondents with business roles, which did not affect the final results of the hypotheses tests.

Measurement Model and Common Method Bias Assessment

We use partial least squares structural equations modelling (PLS) to assess the psychometric adequacy of the measurement model and combine this with multigroup comparison methods to test the proposed hypotheses. The choice for PLS is motivated by the relatively small sample size for each subgroup (i.e., SaaS versus on-premises appliations) (Chin 1998b), the ability to handle formative constructs and multiple dependent variables, as well as the rather explorative character of this study that includes several newly developed constructs (Hair et al. 2011).

To assess the adequacy of the measurement model, formative and reflective constructs are considered separately. For the formative construct (IT governance), all tolerance values (0.883; 0.749; 0.835) are clearly above the recommended threshold of 0.5 (respectively VIF<5) (Hair et al. 2011). Thus multicollinearity can be excluded as an issue for the measurement of the IT governance construct.

For reflectively measured constructs, all item loadings are clearly above the threshold of 0.7, indicating that more than half of their variance is explained by their substantive latent variable. Convergent validity is supported by acceptable values for Crobachs alpha (Alpha>0.7), composite reliability (CR>0.7) and average variance extracted (AVE>0.5) for each of the constructs (Hair et al. 2011), see Table 5.7. We assess discriminant validity by evaluating cross-loadings as well as the Fornell-Larcker criterion (Chin 1998b, p. 321). The mean of absolute item-to-construct cross-loadings is 0.136 with maximum values at 0.633 between the two dependent variables, thus below the critical value of 0.7. Since both constructs (decision authority and task reponsibility) represent core dimensions of application governance, this correlation is in line with our theoretical model and thus does not refute model validity. Second, the Fornell-Larcker criterion, stating that construct-to-construct correlations should be below the square root of AVE (represented as diagonal elements in the matrix), is as well fulfilled for all constructs, see Table 5.7. All item loadings and cross-loadings are reported in Appendix 8.

For all self-reported data, there is a threat for a common method bias (CMB) due to the subjects' motif to give socially desirable and cognitively consistent answers (Podsakoff and Organ 1986). We assess potential CMB by a Harman's one-factor test (Podsakoff and Organ 1986), as well as by including a latent method factor in the PLS model. The first factor from an exploratory factor analysis on all variables of the theoretical model accounts for 0.27 of total variance (loading distinguishably on the items of application governance). This provides a preliminary objection against the existence of a single dominant factor that would explain the majority of variance in the sample (Podsakoff and Organ 1986). For confirmation, we follow the procedure described by (Liang et al. 2007) and include a common method factor in the PLS model that comprises all model indicators and potentially influences the construct's principal indicators.[4] CMB can be assessed by comparing the variance of model indicators explained by substantive constructs with the variance resulting from the method factor. Regarding our model,

[4]For the purpose of CMB assessment, formative constructs (IT governance) may be modeled reflectively (Liang et al. 2007).

Table 5.7: Validity criteria

Operationalization			**Descriptive**		**Convergent validity**			**Discriminant val.** (Latent variable correlations with $\sqrt{AVE}$)											
Construct	Items	Scale	Mean	SD	Alpha	CR	AVE	1	2	3	4	5	6	7	8	9	10	11	12
DecAuth	3	1-5	3.75	0.90	.79	.88	.70	**.84**											
TaskResp	3	1-5	4.06	1.05	.83	.90	.74	.67	**.86**										
ITGov[a]	3	1-5	4.07	0.50	*.56*	*.75*	*.51*	.27	.17	**.71**									
Init	2	1-5	3.44	1.24	.82	.92	.85	.60	.52	.22	**.92**								
Spec	2	1-7	4.46	1.64	.85	.93	.87	.09	.11	-.04	.12	**.93**							
Scop	2	1-7	4.59	1.38	.82	.92	.85	.43	.36	.01	.42	.34	**.92**						
BusKnow	2	1-7	3.94	1.40	.87	.92	.86	.04	-.04	.08	-.03	.03	.02	**.93**					
ITKnow	2	1-7	5.27	1.05	.82	.92	.85	.23	.20	.30	.08	-.03	-.05	.16	**.92**				
Industry	2	1-5	2.56	1.50	.85	.93	.87	-.15	.00	-.10	-.12	.07	-.06	.09	-.10	**.93**			
FirmSize[b]	1	$Lg(E)$	3.17	0.52	1	1	1	-.05	.02	-.02	-.01	-.01	-.14	-.03	.02	-.01	**1.0**		
ITOrg[b]	1	E/I	.023	0.04	1	1	1	-.11	.04	.05	-.22	-.04	-.20	.17	.05	.35	-.11	**1.0**	
Time	1	Yrs	8.16	6.38	1	1	1	.13	.14	-.01	-.03	.24	.29	.03	.01	-.13	.05	.00	**1.0**

[a] IT Governance operationalized as formative variable, thus convergent validity criteria (in *italics*) are not applicable and only for demonstrative purposes

[b] E = number of employees total, I = number of employees in IT

the average substantively explained variance is 0.652 while the average variance from the method factor is 0.015 (ratio 1:44). Additionally, after bootstrapping all substantive loadings remain significant ($p<0.01$), while most path coefficients from the method factor are not significant. Altogether these results indicate that CMB is not a serious concern in this study.

5.2.6 Analysis

The PLS model and its factor scores are used to perform descriptive analyses on the two dimensions of application governance, as well as to assess the structural model and perform subgroup comparisons. We may refer to the research questions posed at the outset (page 18) to structure our analysis.

Patterns of Application Governance – Descriptive Results

First, regarding the question how organizations allocate horizontal authority for applications in general, we find mixed results. For descriptive purposes, we use the standardized factor scores of decision authority (DA) and task responsibility (TR) to perform a hierachical clustering using Wards linkage, a widely applied and well performing clustering technique (Punj and Stewart 1983). We observe a relative drop in the distance measure when reducing from four to three clusters (second derivation of the last four distance measures: 13.9; 9.3; 21.2; 165.3) and thus obtain three clusters. According to the unstandardized mean values (m) of DA and TR, we may say that these clusters represent IT dominated (n_{IT}=150; m_{DA}=4.17; m_{TR}=4.54), business dominated (n_{Bus}=18; m_{DA}=2.21; m_{TR}=1.46), and mixed (n_{mix}=39; m_{DA}=3.00; m_{TR}=3.45) patterns of application governance, see Figure 5.4 (left side). Worth noting, the scatter plot also reflects the strong correlation of decision authority and task responsibility (Pearson's r=.663) with a slight disaggregation towards the lower right, i.e. greater business authority (DA<3.0) combined with greater IT task responsibility (TR>3.0) especially for the mixed governance patterns.

A chi sqare test on the frequency distribution of SaaS and on-premises applications across these three governance patterns (χ^2=14.17; df=2; p=.001) as well as unpaired t-tests on decision authority (T=-1.88; df=205; p=.061) and task responsibility (T=-3.0; df=205; p=.003) reveal, that according to our sample, SaaS is significantly more likely to be governed in a business dominated fashion compared to on-premises applications (i.e., ΔH0 is supported). However, the distribution of SaaS applications by governance patterns clearly depicts that governance of SaaS appliations varies—which is in line with the exploratory case findings in (Winkler et al. 2011a)—and that IT dominated governance is still the prevailing pattern in the majority (59%) of the considered cases of SaaS delivery, see Figure 5.4 (right side).

We may attribute the governance differences between the delivery models to the properties of the SaaS and on-premises application types represented in our sample, that determine the model outcomes. Examining the factor scores of antecedent constructs

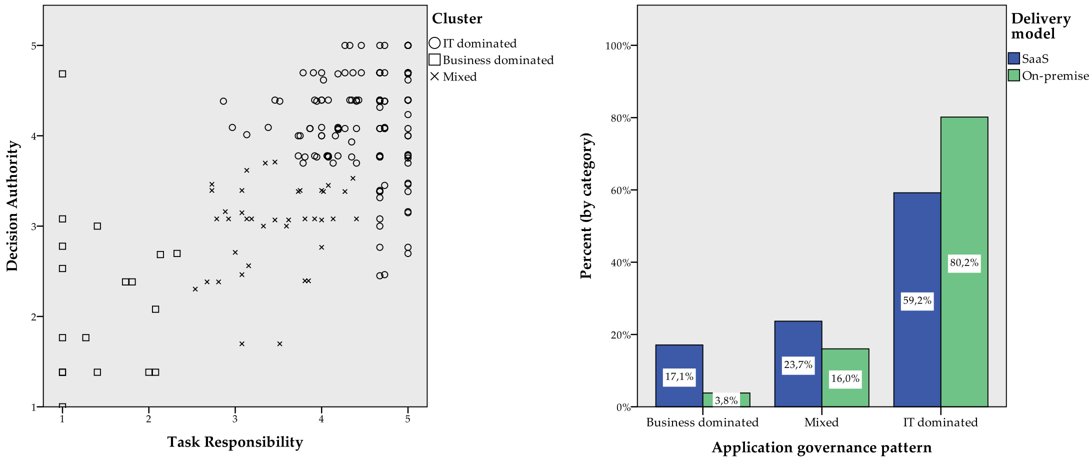


Figure 5.4: Application governance patterns

we find that SaaS and on-premises applications differ significantly in scope of use (T=-6.62; df=205; p=.000), i.e. SaaS applications are less widely used, and in specificity (T=-6.63; df=205; p=.000), indicating that SaaS applications are less customized to the companies' processes. Regarding control variables, there is also a significant difference in the time since implementation (mean 4.05 years for SaaS and 10.28 years for on-premises). Lower specificity, however, would contradict a more frequent allocation to business units according to our hypotheses, which motivates us to look closer at the hypothesized factor relationships.

Determinants of Application Governance – Model and Subgroup Tests

To test our hypotheses, we assess the structural model for all 207 organization-application pairs, as well as for the 76 organizations using SaaS, and the 131 firms providing information about on-premises usage separately. Statistical significance of the parameter estimates is assessed based on the t-values from separate bootstrapping procedures each using 1,000 resamples.[5] We compare the path coefficients of the SaaS and on-premises models (c_{SaaS}, c_{OnPr}) by two kinds of tests: a t-test based on the standard errors as described by (Keil et al. 2000) and an adapted Mann-Whitney-Wilcoxon (MWW) test based on the bootstrap samples (Henseler et al. 2009). Both tests produce congruent results, see Table 5.8 (page 160). We regard paths with test error probabilities p<0.1 as significantly different and thus decide on the support for the differential hypotheses (ΔHx). In addition we assess the effect sizes (f) for those constructs which are signif-

[5] Note: For the subgoups samples, we estimated the model parameters and t-values separately for each single control variable, in order to adhere to the recommended sample size requirements for PLS (i.e., sample size greater than ten times the number of incoming links of the dependent variable, Chin 1998b). A similar approach is taken by (Liang et al. 2007). For the total sample (n=207), all model constructs and control variables were tested together.

icantly associated (Chin 1998b, p. 316). The results of the model test and subgroup analysis for SaaS and on-premises are illustrated in Figure 5.5.

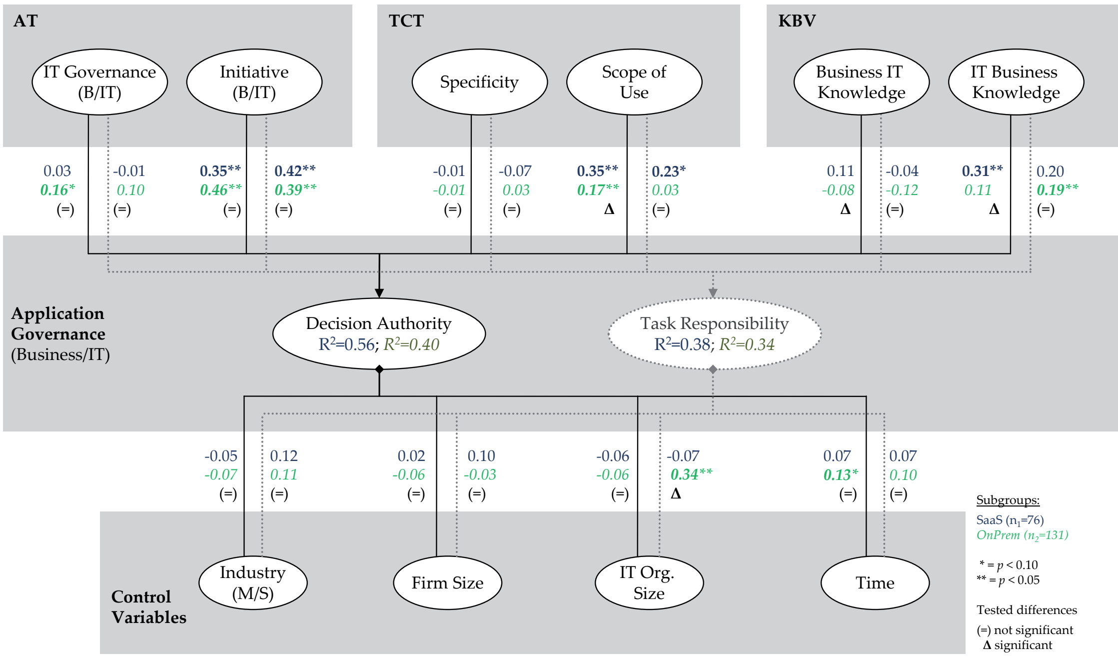


Figure 5.5: Model tests and subgroup analysis

H1: Regarding the first hypothesis, we find that overall IT governance is not significantly related with application governance for the total sample, especially not with task responsibility (H1b). However, we observe a weakly singnificant relationship with decision authority for on-premises applications (c=0.16*; effect size f=0.04) and conclude that the insignificant relationship in the combined sample is caused by heterogeneous influences in the underlying populations. The multipgroup analysis does not siginficantly support the difference in path coefficients (p<0.16; p<0.18), nevertheless, the association of IT governance with decision authority (H1a) is much weaker for SaaS, i.e. practically not existent, compared to on-premises applications. Hence, we may state that ΔH1a is at least partly supported.

H2: We find strong support for the contingent influence of the origin of initiative on both, application decision authority (H2a) and task responsibility (H2b) represented by with the strongest path coefficients in the model (c=0.47**, effect sizes f=0.28 on DA, and c=0.47**, effect size f=0.24 on TR). Multigroup tests do not confirm that this influence is significantly differs with the delivery model (ΔH2 not supported), i.e., the origin of initiative appears to be equally important for the allocation of SaaS and on-premise application governance (c_{SaaS}=0.35** and c_{OnPr}=0.46** on DA, c_{SaaS}=0.42** and c_{OnPr}=0.39** on TR).

H3: According to our model test, application specificity is not significantly associated with application governance, neither for decision authority (c=-0.05, H3a), nor for task responsibility (c=-0.03, H3b). In this case we are unable to attribute this finding to an unobserved heterogeneity in the sample, since the low and insignificant path coefficients are congruent for both, SaaS and on-premises subgroups, which is confirmed by high p-values in the multigroup comparison (i.e., H3 and ΔH3 not supported).

H4: The scope of use is significantly associated with application governance ($c=0.24^{**}$ on DA, $c=0.20^{**}$ on TA), i.e. the more departments and employees make use of an application, the more likely it is to be governed in a IT dominated fashion, yet, the effect sizes of this influence regarding the overall sample are comparably weak (f=0.05 on DA, and f=0.04 on TR). The multigroup analysis shows that the association of scope with decision authority, and to a much lesser extent also with task responsibility, is stronger for SaaS than for on-premises applications (DA: $c_{SaaS}=0.35^{**}$ and $c_{OnPr}=0.17^{**}$; TR: $c_{SaaS}=0.23^{**}$ and $c_{OnPr}=0.03$), thus ΔH4 is supported for decision authority.

H5: Higher business IT knowledge was hypothesized to be asscociated with stronger application governance by business units. This relationship is not significant for task reponsibility (TR: c=-0.10), and not existent for decision authority (c=0.01). Regarding subgroup differences, we find a positive association of business IT knowledge with decision authority for SaaS using organizations (DA: $c_{SaaS}=0.11$). Although this relationship is statistically not significant, it leads to significant subgroup differences on the $p<0.1$ confidence level. We may interpret this significance as a weak support for our hypothesis ΔH5a stating that with SaaS, the businesses' IT expertise is becoming comparaby less important in defining application authority, as opposed to on-premises delivery models.

H6: Finally, we find significant support for an association of IT business knowledge and application governance ($c=0.16^{**}$ on DA, $c=0.18^{**}$ on TR) with low effect sizes (f=0.03 on DA; f=0.02 on TR). Regarding the subgroup analysis, again we observe heterogeneity in the association with decision authority (DA: $c_{SaaS}=0.31^{**}$ and $c_{OnPr}=0.11$; $p<.04$). Multigroup tests show significant path differences between SaaS and on-premises subgroups ($p<0.04$). Aparently the strong link for SaaS applications also causes the significant link in the total sample. This supports our hypothesis ΔH6a implying that for SaaS applications, complementary knowledge in the IT department is comparatively more important to establish, respectively retain, decision authority in the IT department.

Regarding the control variables, we can rule out influences respresented by the type of industry (i.e., manufacturing versus service) and the size of the organization. The relative size of the IT organization significantly influences the allocation of task responsibility ($c=0.18^{**}$), i.e. the more human resources work in the IT organization, the more likely is IT to take over task responsibility, and vice versa. Interestingly, the influence represented by organizational characteristics exclusively results from on-premises applications in the sample ($c_{OnPr}=0.35^{**}$; effect size f=0.12), not from SaaS ($c_{SaaS}=-0.07$), which is supported by the multigroup tests ($p<0.01$). Ultimately, the time since implementation partly influences decision authority for on-premises applications ($c_{SaaS}=0.35^{**}$). That is, more recent governance arrangements for on-premises applications are made in a more decentralized fashion, an effect we control for in our model.

Altogether, the model variables collectively explain 46.7% of the variance in decision authority and 37.9% in task responsibility. Explanatory power is substantively better for SaaS (R^2_{DA}=56.0%; R^2_{TR}=38%) than for on-premises applications (R^2_{DA}=40.1%; R^2_{TR}=33.6%). The influence originating from control variables is negligible except for the effect on on-premises task responsibility (effect size $f_{Controls}$=0.16). The results of the hypotheses tests and multigroup analysis are summarized in Table 5.8.

Table 5.8: Results of the hypotheses tests

H	**Path**	**Model tests**				**Multigroup analysis**		
		All n=207	SaaS n_1=76	OnPrem n_2=131	Association	T-test p	MWW p	Group difference
H1	ITGov→DecAuth	.10	.03	.16*	Partly sup.	.16	.18	Not sup.
	ITGov→TaskResp	.02	-.01	.10		.26	.44	Not sup.
H2	Init→DecAuth	.47**	.35**	.46**	Supported	.21	.20	Not sup.
	Init→TaskResp	.47**	.42**	.39**		.42	.40	Not sup.
H3	Spec→DecAuth	-.05	-.01	-.01	Not sup.	.49	.50	Not sup.
	Spec→TaskResp	-.03	-.07	.03		.25	.26	Not sup.
H4	Scop→ DecAuth	.24**	.35**	.17**	Supported	.08	.09	Supported
	Scop→TaskResp	.20**	.23*	.03		.15	.28	Not sup.
H5	BusKnow→DecAuth	.01	.11	-.08	Not sup.	.10	.06	Supported
	BusKnow→TaskResp	-.10	-.04	-.12		.29	.19	Not sup.
H6	ITKnow→DecAuth	.16**	.31**	.11	Supported	.04	.03	Supported
	ITKnow→TaskResp	.18**	.20	.19**		.48	.32	Not sup.
C1	Industry→DecAuth	-.05	-.05	-.07	-	.44	.35	-
	Industry→TaskResp	.06	.12	.11		.48	.16	-
C2	FirmSize→ DecAuth	-.02	.02	-.06	-	.27	.32	-
	FirmSize→TaskResp	.06	.10	-.03		.19	.30	-
C3	ITOrgSiz→ DecAuth	.04	-.06	.06	Partly infl.	.20	.20	-
	ITOrgSiz→TaskResp	.18**	-.07	.34**		.01	.01	Influential
C4	Time→DecAuth	.08	.07	.13*	Partly infl.	.32	.30	Partly infl.
	Time→TaskResp	.10*	.07	.10		.41	.36	-

$^*p<.10$; $^{**}p<.05$

5.2.7 Discussion

This study draws on the extant IT governance literature to develop a research model that applies multiple theoretical lenses in order to explain two important dimensions of application governance: decision authority and task responsibility. Based on the steady evolution in the technological architectures, our particular focus was on investigating the dynamism that the use of emerging delivery models such as SaaS may imply for business organizations in comparison with traditional, on-premises models. Descriptive analyses of data from 207 organization/application pairs indicate that three patterns of application governance can be distinguished: IT dominated, business dominated, and mixed forms. Empirical tests of our model provide support for *IT governance* (partly), the *scope* of application use, the *IT employees' knowlege* of the business domain, and the *origin of the initiative* being significantly associated with the application governance pattern.

Regarding the role of *IT governance*, we found that the allocation of overall IT decision rights is associated with governance arrangements for on-premises, but not for SaaS applications. This finding may result from the fact that SaaS applications still account for a minor fraction of total application architectures. For such applications that deviate from the overall mode of IT governance, business and IT units may have special arrangements. Conversely, we could argue that a more modular view of IT governance is appropriate: that is, overall IT governance is an aggregation of a multitude of arrangements on application and IT artifact levels. Adopting the latter view would imply that with the increasing prevalence of SaaS based delivery models, overall IT governance is likely to be shaped towards more business dominance. The significant correlation between time and task responsibility in our model at least provides a retrospective argument for the existence of such dynamism in application governance arrangements.

Combining this view with the findings regarding the *scope of use* and *specificity*, we obtain a reasonable explanation for *why* SaaS governance patterns differ from on-premises applications. In line with the transaction cost theoretic view, today's SaaS applications are evidently those that have a smaller scope of use within organizations and are therefore more frequently governed in a business dominated fashion. This fits the argumentation of the long tail for Internet based commodities (Chong and Carraro 2006; Brynjolfsson et al. 2006). Since cost advantages for SaaS largely accrue on the external IT provider side, this emerging delivery model represents a cost-effective alternative for specific application demands that otherwise would not be fulfilled. SaaS applications may often extend existing application architectures, rather than cannibalizing large and highly complex local instances, such as on-premises ERPs.[6] This also implies, that the imperative to leverage economies of scale becomes a much weaker argument for centralizing governance to a corporate IT department when SaaS models are prominent—a finding that is as well supported by the case findings in (Winkler et al. 2011a).

From a knowledge-theoretic lens, the *business knowledge of IT employees* emerges as an important variable associated with application governance, especially for SaaS-based sourcing. This finding underpins previous studies that emphasize the change in the competencies of IT professionals and retained employees in IT outsourcing relationships (Bassellier and Benbasat 2004; Roepke et al. 2000). Conversely, we were able to provide weak evidence that the *IT knowledge of business staff* influences application governance for SaaS *less* than for on-premises applications. We attribute this weak relationship to the fact that business IT knowledge was conceptualized for the entire business organization, rather than for a close group of application users. However, assuming that validity, this finding may reflect a lower need for specialized IT competences of SaaS users for being be involved in application related decision making, compared to traditional IT delivery.

Finally, the origin of the initiative for implementing an application emerges as a crucial

[6]Side note: We included an additional binary item in the survey asking whether the application was introduced as a new solution or replaced a previous solution. The group differences are significant, 40% of SaaS, versus 19% of on-premises applications had been introduced as new solutions.

predictor for both, SaaS and on-premises application governance. This finding does not principally contradict our initial supposition that authority for SaaS applications is allocated largely dependent on the voluntary initiative of either of the parties business or IT. However, it does lead us to assume that this has been an influential factor also for on-premises delivery models. This would represent an unexpected result inasmuch as literature suggests that in formalized IT investment processes, the parties initiating a project can differ strongly from those taking over later application operation and decision making (Xue et al. 2008). Altogether, our finding rather strengthens the agency theoretic view, which suggests that initiative may as well be regarded as one of the facets in the broader class of decision management rights (Fama and Jensen 1983).

Theoretical Contribution

The central contribution of this work is represented by the theoretical framework it provides for explaining governance phenomena. This framework comprises two distinctive novel ideas for which we provide empirical evidence. The first idea is to conceptualize governance on the application level as a subset of overall IT governance arrangements, thus disaggregating the facets of governance along the technological architecture. As we contend, this approach is meaningful in order to connect the analysis of contingencies on organizational level with the influence represented by different properties of enterprise applications—or in general, the “IT artifact” (Orlikowski and Iacono 2001). The results provide evidence that such a disaggregated view is useful to discover arrangements that deviate from (prior) overall schemes—in this case application governance arrangements (specifically decision authority) for SaaS delivery that deviates from overall IT governance. Furthermore, reflecting the agency theoretic imperative to disaggregate decision management and decision control rights (Jensen 1998), we conceptualized application governance by the two empirically correlated but theoretically distinct dimensions decision authority and task responsibility and demonstrated their value to describe different governance patterns.

Second, this work reframes the theoretical basis for explaining governance phenomena by enhancing the view to three theoretical lenses. Although the extant IT governance literature has as well implicitly drawn on constructs from knowledge based and transaction cost theoretic views, this study explicitly integrates these views in a single research framework and conceptualizes corresponding constructs. Other studies, for instance on SaaS adoption, have taken similar approaches in order to facilitate a broader understanding of the phenomenon (Benlian et al. 2009). Regarding our study, transaction cost theory in particular emerges as a valuable lens to identify and operationalize artifact-specific properties, such as application specificity and scope of use. The knowledge based view provides a meaningful lens to capture the specific properties pertaining to the organization and its human resources, which are critical in a governance context. The empirical evidence supports the value of this multi-theoretical framework inasmuch as most of its embodied constructs exhibit clear relationships with the regarded phenomenon, in this case governance on application level.

Managerial Implications

This study offers a number of findings that may guide managerial decision making in the presence of various application adoption contexts (e.g., SaaS and on-premises). First of all, the empirical analysis based on multiple antecedent factors facilitates a contingent understanding of application governance arrangements. For example, it informs that smaller scoped applications may as well be governed in a more decentralized fashion (especially for SaaS) without necesariliy conflicting with overall governance arrangements. Consequently, the notion of overall IT governance may be brought forward from a monolithic understanding of the entire IT function, towards a modular view that captures appropriate arrangements for each single cluster of IT artifacts. Such disaggregated understanding may be helpful given the increasing amout of IT activities that take place outside of the IT department.

According to our analysis, two factors play a crucial role to define governance arrangements on the application level. First, apparently initiators (e.g., single actors or departments) play an important role in IT adoption contexts. Firms may rethink this role and question whether initiators should also be responsible for later application operation and management. This can potentially be achieved by implementing appropriate procedural mechanisms such as idea management processes and project funnels. (Reversely, if initiators know ex ante that large parts of tasks and responsibilities remains with them, they might have less incentive to take a lead in future initiatives) Second, according to our results the knowledge of IT professionals and their insight into business processes poses an increasingly important skill for future IT units to sustain effective decision making and prevent a “drift” of IT authority to the business units. Companies may reconsider the benefits of human resource practices, such as job rotation between business and IT as well as trainings of IT staff, as an effective means to achieve this goal. Altogether, this study may help practitioners to assess the organizational impact that the use of emerging delivery models may have for their organization and the arrangements between business and IT units. Our results dissociate from the radical view of some proponents (Carr 2005), however, we provide relevant insights under which conditions governance shifts may be appropriate.

Limitations and Future Research

Two important limitations of this study merit consideration. First, due to questionaire length restrictions, all model constructs have been operationalized by a relatively low number of items. Arguably, this may have affected the predictive validity of some of these constructs. Although criteria for convergent and disctiminant validity are fulfilled, a semantically broader operationalization of the model constructs may have resulted in significant path coefficients for those hypotheses that are currently only vaguely evident or not significant (Diamantopoulos et al. 2012). Second, a potential unobserved bias of the results may result from the research design. Respondents were allowed to choose the application they wanted to provide information on, which resulted in a broad distribution of different application types across the SaaS and on-premises categories. We assume that this individual choice results in a random sample of applications that is comparable to the overall population of Saas and on-premises applications across organizations (which is unknown). This assumption is especially important when interpreting the descriptive results.

Future research may extend the modular view on governance phenomena in three promising directions. First, the strong influence by the origin of initiative suggests that companies allocate application governance largely in a path dependent way based on the seemingly arbitrary initiative of either party in the organization. Researchers may bring more light on the question of voluntariness in IT governance and adoption contexts. Relevant questions might be, for example, what motivates employees to initiate new technology adoption and how do governing roles evolve? Longitudinal and process-theoretic approaches appear appropriate means to address these issues. Second, while the influence of specificity is widely emphasized by in the outsourcing and SaaS literature (Benlian et al. 2009; Nagpal 2004), its role in the allocation of application governance remaines ambiguous. (We found significant subgroup differences, however, a nonsignificant association with governance). Conceivably, there is an argument for two effects: lower application specificity—operationalized as low customization needs—may allow for more business authority, however, higher business authority may as well cause higher specificity. Future research may address this issue in order to unveil the meadiating factors that justify (or disprove) an influence of the specificity construct on IT artifact-level governance phenomena. Finally, our theoretical model was free from a criterion variable. Thus, we were not able to assess whether a specific application governance pattern is beneficial or not. Reasonably, future research may develop more normative theories for application governance phenomena, based on the antecedent factors provided by this research.

5.2.8 Summary

This chapter addressed the neglected question of how organizations allocate information technology (IT) authority between business and IT units for enterprise applications, with a particular focus on the potential changes that emerging delivery models such as Software as a service (SaaS) may bring about. We theorized that allocations of application authority result from agency, transaction cost, and knowledge-based contingencies and developed a research model that conceptualizes application governance arrangements by the two dimensions decision authority and task responsibility. Empirical tests using data from a survey with 207 large firms provide partial support for our model. The data reveals that authority for SaaS-based applications is allocated more frequently to the business units and—most notably—is established largely independent from overall IT governance arrangements. This study contributes a more modular, application level view to IT governance theory and demonstrates its usefulness to uncover the dynamics represented by emerging patterns of IT delivery. Relevant implications for theory and practice were discussed.

5.3 A Process Model for Explaining Governance of Software as a Service

5.3.1 Preamble

This chapter has been initially published and presented at the German Multikonferenz Wirtschaftsinformatik 2012 in Braunschweig (see Winkler and Günther 2012). Note that one case example has been renamed (Case "A" replaced by "C") to ensure the coherence with Chapter 5.1 of this dissertation.

5.3.2 Introduction

Firms are socio-technical systems. Any change to the technical infrastructure may also imply a change to the internal organization (Robey and Boudreau 1999). When implementing new enterprise applications, business and IT decision-makers face the challenge how to allocate decision rights for the use, management and enhancement of such application. This phenomenon has been commonly identified as an important aspect in IT governance.

In the past, the focus of IT governance has been directed on balancing between centralized (i.e., IT departmental) and decentralized (i.e., business units') decision rights. This appears reasonable, as the internal IT department has been regarded as the focal point of IT delivery. However, emerging delivery models such as Software as a Service (SaaS) are likely to defy this view. With SaaS, a third party comes into play providing large parts of IT delivery, so that business departments may be more inclined to take over large parts of decision authority and application-related activities (Yanosky 2008; Golden 2010; Winkler et al. 2011a).

Previous work on SaaS governance has proposed a contingency model including organizational and technical categories to explain in which cases authority for the SaaS application is rather allocated to the business or to the IT side (Winkler et al. 2011a). However, such models follow a variance-theoretic paradigm. Thus, they are hardly able to embrace complex temporal and causal interrelationships between the factors and fail to explain exactly how they are related (Newman and Robey 1992).

In this work, we build on previous models and take a process-theoretic approach to examine the governance of SaaS-based applications. For this purpose, we first define a process model that considers the three actors business, IT and external provider. Then, we illustrate the applicability of this model in two cases of SaaS adoption to explain different governance outcomes. The comparison of the cases reveals some of the complex relationships and path dependencies between the variance-theoretic factors. The model can be used to study further cases of application adoption and better understand the allocation of application governance in each respective case.

The remainder is structured as follows: In the next section we review related work on IT governance, Software as a Service and process theory. Then, in Section 5.3.4 we present our process approach for investigating SaaS governance. Section 5.3.5 empirically demonstrates the approach in two cases of SaaS adoption. Section 5.3.6 summarizes the results and outlines limitations as well as future work.

5.3.3 Related Work

IT Governance and Subdomains

IT governance is commonly understood as a subset of corporate governance aiming to ensure that the IT organization sustains the organization's strategy and objectives (De Haes and Van Grembergen 2004). Governance mechanisms are installed on structural, procedural and relational level to connect the stakeholders (i.e., the business) and the entities in authority of information technology (i.e., the IT department or external providers) (Peterson et al. 2000). While practitioner literature has much focused much on procedural mechanisms and developed several governance frameworks, such as ITIL and CoBIT (Peterson et al. 2000), earlier IS research has related IT governance primarily to the "locus of authority for IT functions" (Brown 1999), thus to the structural level (Peterson et al. 2000).

Commonly, allocations of IT authority can be classified into *centralized, decentralized and federal* archetypes (Brown 1999; Sambamurthy and Zmud 1999). Weill and Ross (Weill and Ross 2004a) propose a more sophisticated framework comprising six governance archetypes (*business monarchy, IT monarchy, IT duopoly, etc.*), which essentially combine the horizontal (i.e., business vs. IT) with the vertical (i.e., executive vs. employee level) distribution of authority. Building on that, a few works demonstrate that firms need to allocate decision authority depending on their strategic goals, context and environment, for example in order to balance between the need for local flexibility versus global standardization (Weill and Ross 2004a). Some authors have also broken down the concept of IT governance to different subdomains, such as infrastructure governance (Gu et al. 2008) and data governance (Khatri and Brown 2010). Therefore it appears conceivable to draw on governance theory also to explain the mode of governance for Software as a Service, i.e. to explain 'SaaS governance'.

Software as a Service and Application Governance

Software as a Service (SaaS) refers to an increasingly deployed delivery model, where standard enterprise applications are provided as a service over the Internet (Cusumano 2010). Conceptually, SaaS is attributed to the highest layer of the cloud computing stack (Armbrust et al. 2009). SaaS applications differ from traditional IT delivery inasmuch as they are designed for multiple tenants (i.e., user organizations) that share the same underlying infrastructure (Cusumano 2010). Economically, this often correlates with a subscription-based pricing model as opposed to a perpetual-use pricing model for traditional applications (Choudhary 2007b).

In order to reach a broad market, many SaaS offerings are designed for web-based mass customization, making it easier for user organizations to adopt and adjust the application to their own company-specific needs (Sun et al. 2008). This in turn is likely to have an effect on internal governance structures, as some anecdotal evidence suggests (Yanosky 2008). Once business departments can source new software virtually on a mouse click and practically without upfront capital investment, it becomes harder for IT organizations to justify a 'man in the middle staffing' for SaaS applications (Golden 2010). Thus, the SaaS-based delivery model is about to defy the conventional logic behind centralized and decentralized governance.

Contingency Factors of SaaS Governance

Empirical work suggests that firms allocate responsibility for the same SaaS application in different ways (Winkler et al. 2011a). These authors operationalize application governance by two variables capturing the decision as well as the execution level: *decision authority* and *task responsibility*. Both variables can be either allocated to business, the IT department or an external services provider. Furthermore, their work draws on previous contingency theories (Sambamurthy and Zmud 1999) and a grounded theory analysis of four cases to propose a number of factors that influence in the allocation of SaaS governance. The following five factors will also be used in course of this research to develop our process approach:

Corporate governance comprises the degree of *managerial autonomy* and the *strategic IT goals*, which can be either efficiency- or growth-oriented. Firms with higher autonomy in the business units are expected to be more inclined to allocate SaaS authority to business. The influence of strategic IS goals has been ambiguous. While IT governance literature suggests that efficiency-oriented IT goals generally correlate with more centralized autonomy (Brown 1999; Peterson et al. 2000; Weill and Ross 2004a), some evidence suggest that this is not necessarily the case for SaaS applications (Winkler et al. 2011a).

Absorptive capacities in this context refer to business and IT knowledge. The more IT knowledge the business organization has 'absorbed', the more likely it is to take over application governance. Reversely, the more business knowledge IT employees possess, the more likely they are to govern the application (Winkler et al. 2011a).

Initiative characterizes the part of the organization (either business or IT) that brings up the idea for, and is driving the implementation of the application. It is proposed that the initiating party is also more likely to take over application governance (Winkler et al. 2011a).

Specificity refers to the degree of adapting the application to company-specific requirements. For SaaS, this typically takes place through customization (Sun et al. 2008). High specificity is reflected in the degree of integration with the existing application landscape as well as with the amount of training required for the users of that application. Therefore it is proposed that a higher specificity also demands more IT involvement in application governance (Winkler et al. 2011a).

Finally, the *scope of use* measures whether an application is used by the whole company or only a small fraction of employees (Winkler et al. 2011a). Drawing on the rationale of economies of scale, a wider scope of use is expected to correlate with more centralized application governance.

Variance and Process Theories

The contingency model presented in (Winkler et al. 2011a) follows a variance-theoretic paradigm. This class of research seeks to provide empirical associations based on the levels of an outcome (here: allocation of application governance) and its potential predictor variables (Newman and Robey 1992). While possessing the strength to aim for more generalizable results, variance-based approaches do not explain how the outcomes exactly occur (Lyytinen and Newman 2008). Process theories are a complementary alternative which focuses on sequences of events over time in order to explain how and why particular outcomes are reached. Thus, the outcomes become at least partially predictable from the knowledge of the process, not from the level of predictor variables (Mohr 1982).

Process theories provide a vocabulary which is apt to study the phenomenon of interest (Lyytinen and Newman 2008). When integrating factors from variance theories in such vocabulary, however, one should be cautious. Factors should not be understood as predictors of certain events (e.g., the degree of *specificity* of the system causes more work on system integration), but rather as a social action that helps to produce the outcome of interest (i.e., the activity of specifying the system is followed by system integration) (Newman and Robey 1992). In this study, we bear in mind these fundamental differences when connecting process models with factor models.

5.3.4 A Process Model for SaaS Adoption and Governance

In the following we propose a model to analyze the adoption process of SaaS applications with a special focus on explaining the arrangements regarding the governance outcomes of that application. The model comprises elements that define the phases, states, relationships, actors, and domains of governance factors in SaaS adoption.

Phases

Several approaches have been taken to describe the phases in the adoption of enterprise systems (Markus and Tanis 2000; Ross and Vitale 2000). To structure the temporal sequence of action regarding our phenomenon, we define five phases.

The first phase of the model refers to *antecedent conditions and pre-decision* activities. Antecedent conditions are important for any process theory. They refer to the context and historical relationships, which are essentially the outcome of a history of prior activities likely to affect subsequent events (Newman and Robey 1992). We also aggregate relevant activities here that occur prior to the decision for implementing a certain SaaS application.

Second, the *decision phase* refers to activities and events that are related to the decision for the SaaS application, such as evaluating vendors and preparing the implementation project. This largely correlates with the project chartering phase in (Markus and Tanis 2000). The third phase is the *implementation* itself (Ross and Vitale 2000). It typically comprises a number of activities related to specifying and customizing the SaaS solution as well as rolling it out to the organization. In (Markus and Tanis 2000) this is simply referred to as 'the project'.

Any implementation project is followed by application operation and system use, denominated as the *assimilation phase*. Assimilation in this sense refers to the process in which the application is becoming a routinized element of the firm's activities (Armstrong and Sambamurthy 1999). Finally, we aggregate a *future phase* capturing such developments prospected to occur induced by the current use of the system.

States

As indicated, our process model follows the goal to describe the sequence of action that takes place in these phases. The choice on how to discretize this sequence is ultimately a question of the conceptualization of change (Boudreau and Robey 1999). While the *radical view* describes change as revolutionary punctuations followed by episodes of stability, the *incremental view* suggest that change rather occurs as a sequence of small evolutionary adjustments. The punctuated equilibrium view combines elements of both views, stating that change can alternate between both forms (Boudreau and Robey 1999).

We adopt the latter view and define four types of states: *events*, *decisions*, *episodes* and *actions*. Events and decisions represent punctuations which can either follow episodes of stability or concrete actions of small incremental change. For example, the decision to use SaaS is a punctuation within the SaaS adoption process. It can be followed by a series of actions to implement that application, thus causing incremental change. The use of that application can be seen as an episode of stability that, however, may lead to further socio-technical changes.

Direct and Indirect Relationships

The relationships between these states are directed and characterized by temporal and causal dependencies. We differentiate between direct and indirect relationships. *Direct relationships* exhibit a clear temporal sequence and causal dependency, and thus can also be regarded as transitions that form the process. For example, the decision for SaaS (state A) leads to the action of making a contract with the SaaS provider (state B). This refers to a counter-factual understanding of event causality, if A had not occurred B would not have happened (Kim 1999).

An *indirect relationship* can be regarded as a weaker causal dependency. For example, the decision for SaaS (state A) is one of the reasons for an IT representative to leave the firm (state C). Here, causality is used in a probabilistic way, A increases the likelihood of C to happen, however, C could also have occurred without the event A and vice versa (Kim 1999). Regarding the sequence of action, the time between two indirectly related states may be longer.

Actors

Most process theories relate the states to different categories regarding the outcome. For example, a social process model on system development maps each event to any of the three outcomes of acceptance, equivocation, or rejection (Newman and Robey 1992). However, as our change process is less concerned with success outcomes, but with the question of governance between business, IT and the external provider, our mapping relates to the actors. For each state it defines the actor who is mostly concerned with the respective decision, event, episode or action. This does not exclude hybrid mappings, e.g. to business and IT parallely. Graphically this can be illustrated by the use of swimlanes and overlapping boxes.

Domains of Governance Factors

As Boudreau and Robey (1999) note “researchers must specify the actual content of theory”, i.e. the elements that are connected with each other within the theory’s logic. We relate the process states to the factors that are hypothesized to influence in the governance of SaaS applications (see 5.3.3). These factors are per se scaled to different dimensions. Therefore, we widen their notion to factor domains, or ‘second-order factors’ as Lyytinen and Newman (2008) suggest, which abstract from these narrow dimensions.

5.3.5 Empirical Illustration of the Process Approach: Two Cases

The purpose of this section is to demonstrate the applicability of the proposed model to study governance phenomena by analyzing two cases of SaaS adoption.

Case Selection

The case material presented here has been drawn from a previous study. SaaS user organizations were drawn from a customer references sites and contacted formally (see Winkler et al. 2011a for the detailed sampling strategy). Several interviews have been conducted, transcribed, and complemented by secondary material such as company reports and press clippings (Winkler et al. 2011a).

Out of this collection, we chose to compare two cases which exhibit similarities in variables external to the model (e.g., size, industry, and application type), and a strong variance in the outcome variable (i.e., SaaS governance). The two companies chosen are both large and internationally operating, German manufacturing firms that have adopted the wide-spread SaaS solution Salesforce.com (SF) for customer relationship managment (CRM). Company B has allocated decision authority and task responsibility for SF to

Table 5.9: Case key figures

Case B	Case C
Machine tools manufacturing	High-tech manufacturing
70 m EUR revenue	150 m EUR revenue
600 employees	1,700 employees
7 employees in IT	40 employees in IT
1 week SF implementation time	3.5 months SF implementation time (pilot)
60 SF users	150 pilot SF users, 400 global
Interviews: Sales Organizer and SF Key User (B1), IT-Application Manager SAP (B2)	Interview: Head of Competence Center CRM (C1)

the business organization whereas in company C, SF is governed largely by an special unit within the IT organization (a Competence Center CRM). The key figures of both companies are given in Table 5.9.

Case Descriptions

In the following we compare both cases, describe the major developments throughout the phases of SF CRM adoption and complement these with relevant quotations from our interviewees. For the ease of comparison we keep the two-column structure.

Antecedent conditions and pre-decision phase

Company B has a long tradition in producing machine tools and serving customers worldwide.
IT had formerly been a department with more than 20 employees, separated into applications and infrastructure management. However, during the times of economic crisis (2003 to 2005), IT has been gradually reduced to a small department of 7 employees. Regarding IT governance, this department is run as a business monarchy (Weill and Ross 2004a). Our interviewee from IT (B2) explains that "when the board is in the driver's seat, the head of IT, who is positioned much below this, only has to serve."
Regarding CRM, the business representative (B1) tells: "By the time it turned out that we urgently needed a CRM system. We only used self-made solutions. For example, we exported data from the ERP to Excel files and our sales people wrote their reports on an in-house developed software. Reports were then transferred via email to the

Since its foundation in the late 90s, company C had rapidly grown in an emerging high-tech segment and strongly diversified through mergers and acquisitions.
IT-wise, the conglomerate was hardly integrated. For example, sales people did not have real-time information about stocks. Interviewee C1 tells: "IT had a bad image before I started here, ticketing took too long, etc. Also, CRM was a burnt issue. Several initiatives for CRM had been attempted earlier by the business and failed."
In late 2007, the company was forced to restructure and focus on core business. The new strategy called for more global harmonization. In 2008, a new CIO was nominated to lead the new operating model implementation and a corresponding ERP initiative. The new CIO reports on board level, i.e. the IT governance model can be regarded as a duopoly between C-level business and IT (Weill and Ross 2004a).

headquarters and read into the ERP. Every sales representation had its own database, also the subsidiaries. This caused us to set up something more integrated."

A CRM expert with a strong background in CRM and business consulting (C1) was staffed to address the open issue of CRM, and to find a supplementary solution to the new ERP system.

Decision phase

The business started the CRM vendor evaluation. "Finally three vendors were at choice, two server-based systems and Salesforce." The IT raised concerns regarding data security for the SaaS solution, but finally needed to make an exception. B2 says "it went back and forth who decided, and finally business has won". B1 opposes that "it was only the decision of our CEO, who was at the vendor presentation. I had agreed on SF beforehand with the Head of Sales, so it was just a matter of giving the final 'Go'."
The main motivation for SF was to disburden the IT department. Besides, other criteria such as multi-language support mattered. According to B1 "functionality was not decisive" and cost was no major criterion either: "Over a period of five years there was no major difference in total cost."
In course of the decision for SaaS, the SF responsible on IT side left the company and handed over the topic to our interviewee B2, who states: "If the thing [CRM system] had been with us, my colleague would probably not have left the company that fast." The contract with SF was closed in 2006.

The new CRM Manager started the vendor evaluation. "I evaluated the classics, SAP, Siebel, Microsoft and Salesforce, until it was decided that we want to go for on-demand [i.e. SaaS], not on-premise. Then, we went further in the area of SaaS and rated different criteria until we said, ok SF is what we liked best. The decision to go for on-demand came directly from the IT strategy. We had this outsourcing project and the guideline was to operate internally as few servers as possible."
The reasons that spoke in favor of SF were usability, support for mobile devices and foremost "our CIO wanted transparent costs". Security issues were not a concern, particularly not in comparison to traditional outsourcing: "If you look at the security concept of SF, I would even say that this is better than the security concepts of our outsourcing partners". Costs were not major criterion either: "Of course, at some point you are break-even, for example after four years, but we did not calculate this scientifically."
The company decided to conduct a pilot rollout of SF in one region (Spain) first, in order not to interfere with the ongoing ERP rollout in Germany.

Implementation phase

The Sales Organizer (our interviewee) wrote the technical specification together with a consultant from Salesforce.
The next task was data migration. The business respresentative (B1) "had to prepare the existing spreadsheets, documents and data from the ERP" to import them into SF.
At this point, the IT was not involved into the rollout activities at all. The actual rollout activities were carried out by the Sales Organizer, the

In order to guide the pilot rollout, a Competence Center CRM was established and staffed with a second CRM expert for the Spain rollout. The Spain pilot was rolled out in two legal entities, replacing a number of local databases and Excel tools. C1 emphasizes: "We worked with an external partner there who conducted workshops, documentation, and took over customization, testing and user trainings. We gained a lot of experience by this how SF works and how it's customized.

SF consultant and an external integration partner. B1 notes that “alone we would not have been capable of doing that”.
Together with the SF consultant, the system was customized according to the specification. B2 states: “We only needed five workdays for the specification, not more”.
The responsibility of the integration partner was to program an interface to the ERP, which created the largest effort. IT was involved here to provide adequate connectors. B2 explains: “we created a one-way interface to SAP that polls the data from SAP and sends it over an i-doc connector to SF. Our man only provided the things that were required and later took over maintenance of the interface”
Trainings were not a major issue. B2 states that “the business [i.e. (B1) himself] trained all the users. That went without complications. It was not more effort than for other applications, maybe even less.”

The project took about 3½ months.”
Integration with backend systems was done later, after the go-live of the ERP system in 2009 and the global rolling of SF. “The integration with the ERP caused some IT efforts since they [the ERP team] implemented the interfaces themselves. [...] Now we exchange data such as offers, orders, bills, delivery receipts, products and prices. So there is a lot happening”.
One of the things that was underestimated during the rollout was the effort for change management. C1 states “you need change management people on the project who explain things to the other users. This is always a very critical point, especially for CRM projects. There are many things that change, sales people need to disclose their figures – a thing which no sales person likes to do.” The issue was addressed by trainings, communication and later “developing strong key users in the regions and business units.”

Assimilation phase

The system is currently used by 55 employees in the sales department, “a hand full of users in the production areas and by the foreign subsidiaries in China, the US and Italy.”
First level support for these users is provided via the classic incident management by IT, second level requests for SF are then passed to the SF Key User.
Requests for changes from the users are collected and evaluated by B1, who is also in charge of implementing them. B1 states: “we have to consider the tight personnel situation overall and in IT. Existing positions have not been staffed [...], so that inevitably I have to take over things which are usually not part of my job description”
Regarding involvement of internal IT he continues “for SF we only have one touch point with our IT, which is the interface to SAP [i.e. the ERP system].”
In case of special customizations, the business

SF was first provided to the 150 users in Spain and then incrementally taken into use by Germany, the US and other legal entities, currently counting about 400 users.
First level support is provided by global help desk, second level requests regarding SF are forwarded to the Competence Center CRM, by now a team of three experts.
This team also decides on requests for changes and implements them in SF. More than that, it understands itself as a consultant to the business. “We are positioned very consulting-like here and do the specification, implementation, training and testing. Most of us also come from consulting, i.e. they have the business process expertise as well as the technical expertise. Therefore we are also able to customize the system ourselves.”
In terms of the technical interfaces to SF, there are some discernable efforts also for the ERP team. “I guess the effort is about 1 one person-day per

would directly contract external partners, for example for a module to print reports of onsite visits: “That was an external partner working for us, and it also went without IT. The requirements came from us, and ultimately IT was not involved”, B1 adds.
Regarding future enhancements, B1 gives into consideration that “I would love to do more things in SF, but unfortunately I don’t have the time for it.”

week. That’s just because we built this buffer-acknowledge-database. That was programmed by the ERP team, so they have quite some effort with maintaining this.”
B1 reports that tickets for SF are even increasing due to a certain loop for further enhancements: “The people know that you can do a lot with SF, so they to push further processes into SF. Some business experts are really demanding a lot.”

Future

Since introducing SF, further SaaS-based enterprise solutions have been used, such as document management and enterprise content management. However, those are not as widely used and as integrated as SF.
B1 also states: “I would appreciate if I could perform minor customizations also in the ERP, without going via IT. That wouldn’t be of a disadvantage for the company. It is just the decision that all customizations of the ERP stay with IT – for other applications this is different.”

Overall, the Head of the Competence Center (C1) would agree that his “IT people can perform higher value work through working with the external solution.” The CIO has received positive feedback from business, “which was not normal. It was just because we can react fast.”
Based on the company-wide use and assimilation, a new strategy evolved to exploit SF for further global harmonization. “It was mid last year that we said, there is no use if the CRM templates are different in each country. So now, every country will get the same core template.”

Processes of SaaS Adoption

We modeled the two cases of SaaS adoption according to the proposed model. The resulting processes are depicted in Figure 5.6. For space constraints we only display a rough overview. Detailed illustrations can be found in Appendix 7 (pages 266-267).

States are represented by rectangular shapes (diamonds for decisions). Direct relationships are depicted as solid lines and indirect by dotted lines. Furthermore, the states have been mapped to the respective factor domains, which are also expressed by different color shades, see Figure 5.6.

Factor Interrelationships and Case Comparison

In order to obtain information about the relationships between the factors of SaaS adoption from Winkler et al. (2011a), we aggregate both processes according to the factor domains. This aggregation omits relationships between states of the same domain and therefore focuses on the direct, as well as indirect inter-domain relationships. As a result we obtain a partially directed graph which describes the relationships for each of the cases qualitatively, see the Figure 5.7.

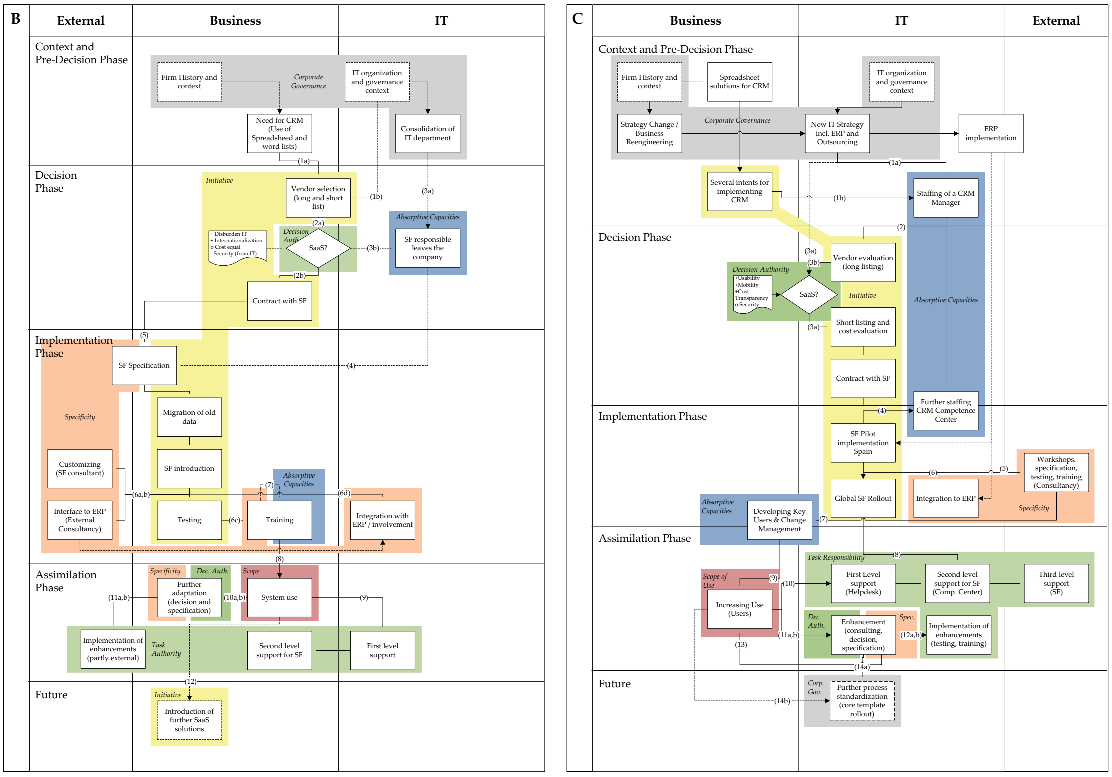


Figure 5.6: SaaS adoption processes (overview)

For coherence, the relevant relationships have been numbered in each of the figures. While the two interrelationship graphs are not identical, we can still identify some common paths through the graph. For the purpose of interpretation we will compare both cases along this dominant common path.

Corporate Governance ⇒ Absorptive Capacities ⇔ Initiative: Corporate governance is the starting point for both processes. For company C, the IT strategy led to staffing a new CRM Manager who brought about special business- and IT-specific knowledge (i.e., absorptive capacities) and took over the initiative for the CRM project. In company B, the business-centric overall governance mode, as well as the efficiency focus in corporate and IT governance, led to anchoring the initiative in the business. This tendency was reinforced by losing key IT personnel, such as the SF responsible on IT side, over the discussion on security issues. This, we argue, led to a further shift of the initiative towards the business.

Initiative ⇔ Decision Authority: We observe that the actual decision authority over the later SaaS operation is already manifested in the party that largely decides on the question for or against SaaS. In case C, this is the IT department, where the final decision for SaaS came from the new CIO's IT strategy. For case B, this is the business, so that we assume that these two domains are closely related.

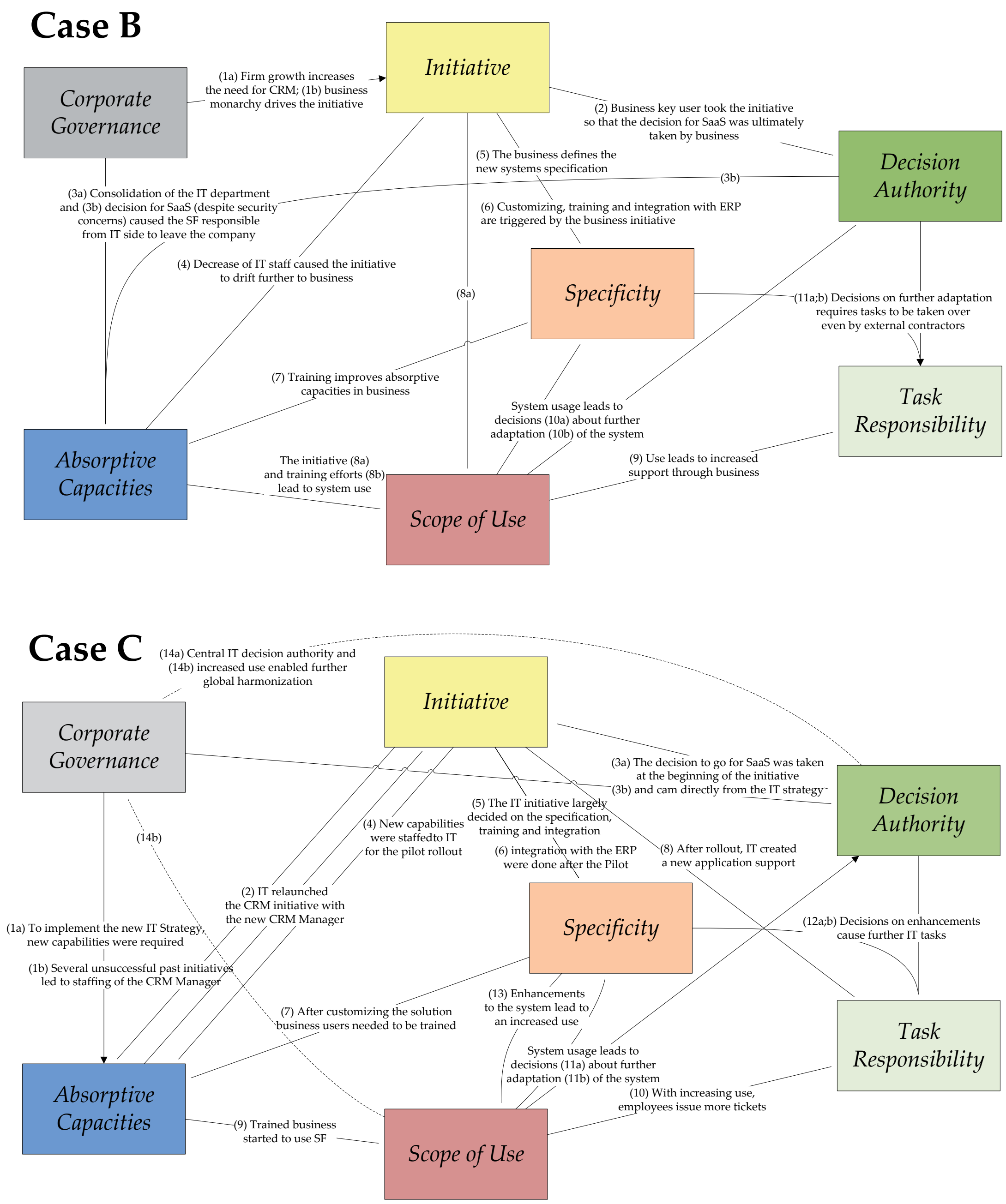


Figure 5.7: Interrelationship of application governance factors

Initiative ⇔ (Absorptive Capacities) ⇒ Specificity: Next, the initiative driving the SaaS implementation strongly influences the specificity of the system. In case C the IT, more precisely the Competence Center CRM did large parts of the customization work, yet relying strongly on external partners for the pilot rollout. Thereby, and by staffing new capabilities to the Competence Center, IT has also gained crucial knowledge for future application governance. For case B, the system has been largely specified and adapted to company requirements by the business representative and external support. Comparing the project durations and the amount of work for training and integration, we may assume that the degree of specificity is considerably larger in case C. Reversely, we may also conclude, that in case B less change management and training efforts for business users was required, due to the fact that the initiative was already directed from the business organization.

Specificity ⇒ Absorptive Capacities ⇒ Scope of Use: Consequently we deduce that through change management and training, more absorptive capacities are built on the user side. This in turn leads to an increased use, and thus scope of use of the system. Especially in case C we observed that system use did not occur instantly, but as a development. This may also be related to the larger training efforts in case C.

Scope of Use ⇒ Decision Authority ⇒ Task Responsibility: Increasing use of the system consequently leads to more decisions on changes and their respective implementation. Case B shows that, in absence of internal capabilities, the task responsibility for such further enhancements is contracted out to external partners. In contrast in case C, the IT department is handling SF-related activities (i.e., change implementation and support) largely on its own.

Scope of Use ⇒ Specificity (⇒ Scope of Use): At least for case C, the ongoing enhancement of the system and adaptation to specific business processes can also be interpreted as a reinforcing cycle. A higher specificity is leading to an increased use, which in turn creates more demand to enhance specificity, as long as the demand can be satisfied.

Further indirect effects: In case C we learned that this system enhancement is also impacting again the overall governance mode, inasmuch as a further business harmonization is enabled. For case B we might argue that the SaaS initiative itself has triggered further initiatives to implement SaaS for other enterprise applications.

5.3.6 Conclusion

In this work we took a process-theoretic approach to better understand the complex interaction of factors that influence the allocation of authority for SaaS-based applications. Therefore we first proposed a process model that is suitable to examine governance in application adoption processes. Then we illustrated the applicability of the model in two cases of companies using SaaS for CRM, and explained the different governance outcomes.

A few conclusions can be drawn regarding the causal relationships and path dependencies between the factors. First, regarding corporate governance we outlined how strategic IT goals as well as the overall mode of IT governance have a bearing on the initiative and where it is coined. The locus of initiative, as well as the decision for SaaS as a culminating point, seem to determine at a very early stage which party is likely to take over decision responsibility for later application operation. Thus, the initiative emerges as a central variable that connects the overall mode of IT govance with the later SaaS governance outcome. However, the initiative as such also interacts with absorptive capacities. On the one hand, existing capacities influence the degree of involvement of the parties, both business and IT, into the initiative. On the other hand, capacities are also increased through the initiative, for example through staffing or training new staff. We also find that application specificity and scope of use cannot necessarily be regarded as exogenous variables. They are determined at a rather late stage of the process and interact with variables such as absorptive capacities and the governance outcomes.

The chosen approach possesses some inherent limitations, foremost regarding generalizability. Since we focused on the SaaS segment for CRM, these results cannot instantly be transferred to all types SaaS applications. Also, the process modeling and assignment to factors may not always be straightforward due to the interpretive approach taken in this research. Finally, the sampling of two cases cannot be regarded as sufficient to produce stable results regarding the relationships between the factors.

However, the results generated here represent valuable insights as they add a new complementary dynamic view to the contingency model presented in (Winkler et al. 2011a). Such temporal and causal interrelationships can be particularly of interest when advancing from a contingency model to more complex path modeling and analysis techniques, such as structural equation modeling. An analysis using a much broader basis of quantitative empirical data is currently underway as further research.

Furthermore, the proposed model can be regarded as a first step to conduct more process-theoretic research in the domain of IT governance. This appears reasonable, as governance can be regarded as a highly dynamic construct that changes throughout various IT implementation contexts. As more research and practical experiences regarding SaaS governance accumulate, our hope is that more precise elements can flesh out the content of the proposed model and improve its predictive power.

5.3.7 Summary

Defining the allocation of decision rights for enterprise applications is a crucial issue in IT governance and organization design. Today, emerging delivery models such as Software as a Service (SaaS) defy the notion of the internal IT department as the focal point of centralized governance. Recognizing the importance of this issue, we find that the phenomenon of ‘SaaS governance’ itself is not yet well understood. Based on two cases of SaaS adoption, we take a process-theoretic approach to investigate the complex interaction between factors that influence in the allocation of SaaS authority. The results suggest that some factors, such as the locus of initiative and the decision for SaaS, interact with absorptive capacities and determine the later mode of application governance at a very early stage. Thus, the initiative for introducing SaaS emerges as an important intermediate variable between the overall IT governance mode and the resulting SaaS governance outcome.

5.4 The Dual Role of Information Systems Specificity for Governing Software as a Service

5.4.1 Preamble

This chapter presents an extended version of a paper that is to be presented at the International Conference on Information Systems 2012 (see Winkler and Benlian 2012). Enhancements in this version largely relate to the analysis presented in Section 5.4.6, which did not enter into the conference submission for space constraints.

5.4.2 Introduction

Organizations today need to manage expanding information technology (IT) landscapes and a multitude of internally and externally operated business applications (O'Brien 2005). The way that each of these subsystems is governed may certainly depend on the type of application itself.[7] For example in large firms, ERP systems are often operated and managed by centralized competence centers within the IT organization (Kræmmergaard and Rose 2002; Miller et al. 2004), as opposed to emerging social software tools that tend to be managed with very strong business ownership (Deans 2011). Defining such governance arrangements between business and IT stakeholders is a common challenge for organizations, especially given the increasing amount of services that are provided through third-parties. Although the IS literature has widely recognized the importance of governance arrangements for the overall IT function (e.g., Brown and Magill 1994; Sambamurthy and Zmud 1999; Weill and Ross 2004a), few works have addressed governance arrangements specifically on the application level. This is remarkable, considering that IT artifacts and their structural and social embeddedness in organizational contexts are often seen at the core of the IS discipline (e.g., King and Lyytinen 2006; Orlikowski and Iacono 2001).

Notwithstanding, the mere knowledge of the software's category and a vague sense of its functionality are certainly *not* sufficient to advance towards a general understanding of governance patterns across different application types. This is mainly because applications of the same 'type' may still cover different functionalities (e.g., an ERP system may include some functionalities of a CRM), and in case two applications would exhibit a comparable functionality set, they can still be utilized by organizations in very different ways (Jasperson et al. 2005; Strong and Volkoff 2010). The misfits arising between the (often rather generic) functionality set of an enterprise application and the (concrete) organizational context are commonly addressed either through changes of the software (i.e., customizations) or changes to the organization itself (Sia and Soh 2007; Soh

[7] With the 'type of application' we refer to the bundle of enterprise functions that are supported by a software application. These software types are often clustered and denominated by acronyms such as ERP (Enterprise Resource Planning), CRM (Customer Relationship Management), SCM (Supply Chain Management), HRM (Human Resource Management), MES (Manufacturing Execution Systems), CCC (Content, Commnunications and Collaboration Suites), etc.

et al. 2000; Strong and Volkoff 2010) during the process of organizational 'embedding' (Orlikowski and Iacono 2001, p. 126). Thus, the relevant question from a research perspective is, *what* are the pertinent and salient properties of *the entire information system* that lead to different application management and governance outcomes during this process?

Transaction cost theory has evolved as a valuable lens to capture the specifics of enterprise applications—foremost in IS outsourcing contexts—by postulating an important, if not essential, characteristic of an IT artifact: *asset specificity* (Williamson 1979; 1981; 1985; 1991; 1996). According to this view, for example, enterprise applications that are highly specific to a company's processes are less likely to be outsourced (e.g., Aubert et al. 2004; Benlian et al. 2009; Dibbern et al. 2005; Loebbecke and Huyskens 2006). However, the IS literature has conceptualized and measured this construct in different ways and attained mixed explanatory value from it. Especially the influence on the decision to outsource remains inconclusive in many (i.e., more than half) of the past IS studies (Karimi-Alaghehband et al. 2011; Lacity et al. 2011). Therefore recently some authors have demanded better appropriations of transaction cost theory (Karimi-Alaghehband et al. 2011) or even called for theories that are endogenous to IS to explain outsourcing governance phenomena (Lacity et al. 2011).

In this work, we build on the extant literature and extend the notion of asset specificity to embrace specificity characteristics of 'ensemble' information systems (IS), i.e. of the application including its organizational and technological context (Orlikowski and Iacono 2001, p. 135). We conceptualize IS specificity by three components (functional specificity, human asset specificity and technical specificity) and study the impact of these components on application-level governance. More precisely, we focus on the horizontal distribution of decision authority and task responsibility between business and IT units as a fundamental dimension of application governance arrangements.

As the question of application governance arrangements becomes more prevalent with increasing application outsourcing to/ and sourcing from external providers (Brown 2003, p. 202), we draw on survey data from 76 organizations that use different types of software *as a service*.[8] The results of our analysis unveil the dual effects that different components of IS specificity have on application governance arrangements for SaaS. We show that greater technical embedding (technical specificity) is associated with stronger IT authority, while greater organizational embedding (human asset specificity) correlates with stronger ownership by business units. A mediation model as well as an extended model (including the influence exerted by usage characteristics) support the significance of this and other transaction cost theoretic constructs in an application governance context. Furthermore, we provide a visualization of different application types and their 'specificity similarities' to provide concise practical guidance for managing heterogeneous application landscapes.

[8]SaaS refers to the use of business applications over the Internet from an external provider and is commonly seen as the highest layer in Cloud computing (e.g., Cusumano 2010). Several authors argue that SaaS and Cloud computing also pose new management challenges for business and IT units (e.g., Bento and Bento 2011; Khajeh-Hosseini et al. 2010; Winkler et al. 2011a)

In the remainder of this chapter we first explain our theoretical lens (5.4.3), followed by the research model (5.4.4), the description of the methodology (5.4.5), the analysis (5.4.6) and a discussion of theoretical and practical implications (5.4.7).

5.4.3 Theoretical Lens

Transaction Cost Theory (TCT) puts transactions, defined as the *ultimate unit of economic activity* (Commons 1931), and the cost for planning, adapting, and monitoring this activity into the focus to explain the existence of institutions, whether they are bureaucracies, markets or other organizational forms (Williamson 1985). Williamson uses the term *transaction cost* synonymously with *governance cost* and *coordination cost* and delineates these from the costs of production. According to this view, the boundary of an organization (or an organizational subunit) extends to the point where total costs for hierarchically coordinating transactions exceed the costs for coordinating via the market. Variables that influence transaction costs have been defined as asset specificity, uncertainty and the frequency of transactions, whereas asset specificity is deemed the most important (Williamson 1985, p. 52). For example, when the required assets are idiosyncratic (i.e., highly specific) and frequently required, the costs for coordinating these transactions internally, as well as uncertainty surrounding the transaction, are presumably lower than when a firm needs to find, contract out and perform the transaction with a partner on the external market. Based on TCT, organization theorists have also viewed firm boundaries as a continuous choice that may lead to diverse hybrid forms, i.e. arrangements between the polar market and hierarchy extremes (e.g., profit centers, Hennart 1993; Williamson 1991).

Assuming that boundary choices are a parallel notion to allocations of authority, TCT may also inform governance arrangements between business and IT units. Or, in the words of Whetten et al. (2009), we may "borrow" TCT as a theoretical lens and transfer it to the context of IT governance phenomena between business and IT units (cross-context) on the subsystem level of single applications (cross-level). According to this view, business units decide whether to enter into a 'contract' with IT units (i.e., to use the firm-internal market) or govern application operations in a hierarchical form (i.e., business unit internally) depending on application-related transaction costs. Analogously to Lacity et al. (2009, p. 146), we argue that the notion of a 'transaction', however, may be less adequate for the IS domain, since it implies that these internal contracts have defined entry and exit points. Information systems, in contrast, are characterized by changing requirements and a continuous evolution (e.g., through updates and enhancements) rather than discrete transactions with a certain frequency and uncertainty. This leads us to make several appropriations when casting TCT into application governance problems.

First, costs of application-related 'transactions' can be best understood as *coordination cost*, referring to the continuous efforts for planning, adapting, and monitoring application operation—as opposed to 'production' cost, e.g. for personnel, software licenses and operating technological infrastructure. In line with TCT, organizations seek for the best governance mode of applications to economize on total cost. Arguably, coordination costs are lower under direct coordination within business units (i.e., hierarchical coordination), while production is more efficiently coordinated by a (centralized) IT unit, due to the possibility to leverage internal economies of scale effects (e.g., through a better utilization of IT resources across the enterprise). However, when operating applications at an external party—as it is the case for SaaS—, the rationale of leveraging internal production cost advantages becomes much weaker, since the economies of scale accrue on the provider side. That is, production costs (expressed by the fees of the provider) are largely independent from the internal coordination form. Thus the question on application governance becomes merely dependent on the costs of coordination.

Second, the frequency of transactions, often defined as "the repetitiveness of a certain type of transaction" (Karimi-Alaghehband et al. 2011) appears less applicable to the context of long-lasting information systems. When introducing the frequency construct, Williamson originally pointed at the amount of "buyer activity in the market" (Williamson 1979, p. 247), i.e. in our context the amount of business activity in information systems use. This property, we argue, may be captured better by the *scope of use* of an application within the wider organization. According to TCT, the scope of use then moderates the relationship of asset specificity on application coordination cost (Karimi-Alaghehband et al. 2011; Williamson 1981). That is, given a certain degree of specificity, more business activity (i.e., a greater scope of use) will also increase the cost for coordinating the management of the application. Thus, scope of use is also expected to play a reinforcing role for the effects of specificity on application governance.

Finally, as a third appropriation, we assume that in an intra-organizational context, behavioral uncertainty defined as "strategic non-disclosure, disguise or distortion of information" (Williamson 1985, p. 57) plays a minor role compared to contractual situations with external, i.e., potentially unknown, agents on the market. Moreover, meta studies in an IS outsourcing context (Karimi-Alaghehband et al. 2011) as well as in the broader strategic management literature (David and Han 2004) document a general explanatory weakness of this variable, which corroborates the argument to omit this variable in our theoretical lens. The appropriation of the core construct of TCT, *asset specificity*, will be treated in the following section, after we conceptualize appropriate dimensions of application governance.

5.4.4 Research Model

This work aims to investigate the relationship of IS specificity on application governance arrangements. We derive appropriate constructs from the extant literature, conceptualize their meaning in the context of the governance of SaaS and hypothesize relevant relationships. The overall research model is depicted in Figure 5.8.

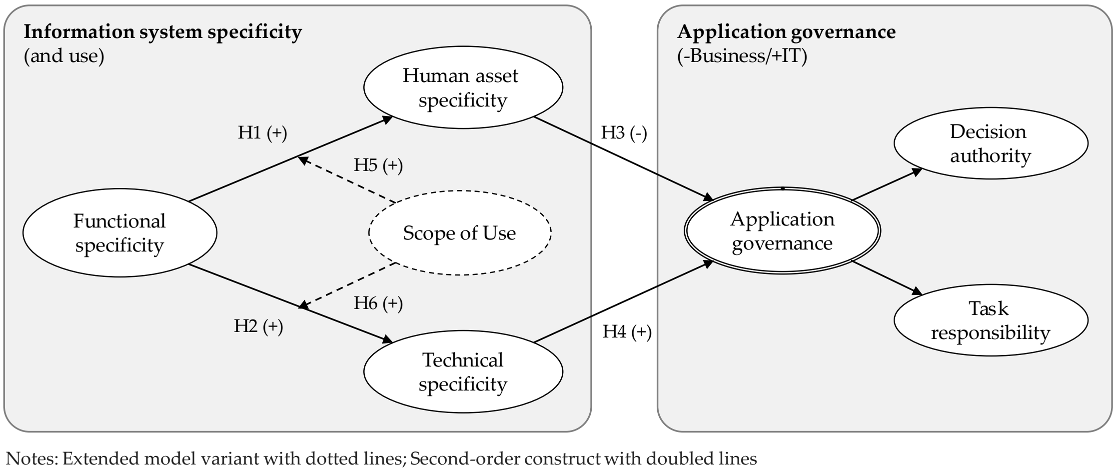


Figure 5.8: Research model

Application Governance

The notion of ‘IT governance’ has been shaped by researchers and practitioners and evolved over the last two decades. Departing from the discussions on the centralization versus decentralization of the IT function, the early IT governance literature has primarily focused on the distribution of IT decision rights between divisional and corporate IT units (e.g., Brown 1997; Brown and Magill 1994; Sambamurthy and Zmud 1999; Weill and Ross 2004a). Later—also influenced by the increasing pervasiveness of ‘best-practice’ governance frameworks such as ITIL and COBIT—authors emphasized the importance of complementary mechanisms to implement such governance arrangements, such as certain roles, defined processes, and service level arrangements (e.g., Peterson et al. 2000; Van Grembergen 2004; Weill and Ross 2004a). While the past literature has primarily viewed IT as a bulk function, recently also more fine-grained conceptualizations of governance arrangements have been proposed, such as for data governance (Khatri and Brown 2010), development project governance (Tiwana 2009), infrastructure sourcing governance (Xue et al. 2011), and application governance (Winkler et al. 2011a).

Analogously to IT governance, application governance is concerned with the design of decision rights and complementary mechanisms to deliver expected value from the use of business applications. One of the most fundamental dimensions of application governance is certainly the degree to which application-related decisions are shared horizontally within the organization, i.e. between business and IT units (Winkler et al. 2011a).[9] This dimension is fundamental in the sense that organizations would probably first assign the major accountabilities for managing a business application, before deciding on detailed governance processes, responsibilities, performance measurement and charging schemes.

[9]Note, that this dimension delineates from the *vertical* distribution or decision rights, e.g. across C-level, senior management, middle management and staff roles (Weill and Ross 2004a).

Conceivably, such internal agreements may be especially valuable also in an outsourcing context, where the "view of only two stakeholders—the client firm and the supplier firm—is too simplistic" (Lacity et al. 2009, p. 149).

The agency theoretic imperative to separate decision control from decision implementation (Fama and Jensen 1983) suggests the existence of two classes of application-related decision rights, which have been introduced elsewhere as *decision authority* and *task responsibility* (Winkler et al. 2011a). This is, the principal makes control decisions regarding the management of an application which are to be implemented by an agent (Tiwana 2009). For example, as common governance frameworks suggest, application change decisions might be agreed by a change advisory board (comprising business and IT stakeholders) and implemented by a change manager on IT side (TSO 2011). In our theoretical model, however, we consider a bundle of decision rights as well as a bundle of actors (i.e., business and IT units). Thus, in the given example, we might find mixed decision authority on control level and greater IT authority on implementation level. Therefore, both of these dimensions can be conceptualized as a continuum with greater ownership by one or the other side, rather than a discrete set of allocations.

Generally, there may be a certain delta between decision authority and task responsibility (e.g., business units are likely to have more decision control rights, while IT units possess more implementation decision rights). However, we argue, that these dimensions are still highly correlated (i.e., the delta is not likely to change substantially in magnitude or sign across cases), so that both dimensions together ultimately reflect an overall application governance dimension. Weill and Ross (2004b) make a similar argument. They define seven rather sophisticated patterns for distributing IT decision rights horizontally and vertically within an organization (e.g., business monarchies, IT monarchies, duopolies, federal, feudal and anarchy patterns). However, finally they conclude that all of these patterns can be ultimately arranged on a single centralization/decentralization scale. Thus, we may conceptualize the two subdimensions as first-order factors of an overall second-order application governance dimension (Edwards 2001, p. 146).

Decision Authority Decision authority captures the distribution of application-related decision control rights between business and IT stakeholders. Over the lifecylce of a business application—i.e., from the requirements analysis, design and/or vendor selection, building and/or deployment, operation, optimization and phase out (van der Pols 2004)—a multiplicity of single decisions (e.g., on the initial investment) and recurrent decisions (e.g., on regular change approvals) accrue. For example, Weill and Ross (2004a;b) use six classes of overall IT decision rights that refer to IT principles, IT infrastructure, IT architecture, business application needs, as well as IT investment and prioritization. Arguably, from these classes the latter three appear most applicable to the application level (moreover in a SaaS sourcing context). Similar to the overall application governance dimension, we argue that the allocation of such decision rights is strongly correlated, so that they can be ultimately reduced to a single dimension. Analogously, the allocation of any application-related decision control right thus ultimately becomes a (good or bad) indicator for the decision authority subdimension.

Task Responsibility Task responsibility refers to implementing application-related decision rights, or simply, to the execution level. Thus, this dimension is concerned with *who is doing* the requirements analysis, the design and/or vendor selection, the building and/or deployment, operation, optimization and phase out (van der Pols 2004). Arguably, for conventional IT applications (meaning those that are operated in-house), the scope of task responsibility is fairly wide and may include application development and integration, infrastructure operation as well as user support tasks. However, for externally operated applications—such as SaaS—few activities remain with the client organization. Susarla et al. (2010, p. 93), for example, propose a task structure for SaaS CRM services that consists of seven tasks, out of which only two ('mapping SaaS to business requirements', and 'streamlining customer-facing activities') are performed by the client organization. In our lifecycle framework these categories would largely relate to requirements analysis for initial deployment and ongoing application optimization (i.e., implementing changes). Furthermore, Winkler et al. (2011a) point out that for many SaaS offerings end-user support is an activity that remains with the client organization, and which is not allocated to IT units 'by default'. Analogously to decision authority, we argue that such task responsibilities are likely to be strongly correlated. Therefore, any allocation of any single task responsibility would as well represent an indicator for this subdimension.

Information System Specificity

In line with Williamson's (1996, p. 105) definition of asset specificity, we define IS specificity as *the degree to which an IS can be redeployed to alternative user organizations without sacrifice of its productive value.* When developing the TCT, Williamson emphasized that specificity can derive from various categories of assets, foremost the geographical location of an investment (site specificity), the employees' knowledge, expertise and learning (human asset specificity) and the specialization of equipment and tools (physical asset specificity) (Williamson 1979; 1981).

IS researchers have mostly aggregated different facets to a single dimension, when applying TCT to study IS phenomena (see Karimi-Alaghehband et al. 2011 for a systematic review). For example, in a study on SaaS adoption, Benlian et al. (2009) operationalize application specificity as the "degree that specific applications can be customized, integrated, and modularized prior to and in the outsourcing relationship." Dibbern et al. (2005) focus on human resource specificity to study a similar phenomenon and operationalize this construct by four subdimensions (unique business knowledge, unique software knowledge, social collaboration IS/user, social collaboration within IS). In a study on 'netsourcing', Loebbecke and Huyskens (2006) consider items related to technical specificity, site specificity, and human capital specificity. Aubert et al. (2004) study outsourcing of diverse IT functions and possibly use one of the broadest operationalization of asset specificity with 24 indicators relating to categories such as "client investment, human resource (HR) specificity, HR hiring delay, HR trainings delay, supplier investment, [and] structural liaison devices".

The explanatory value that IS researchers have obtained from this variable, however, remains mixed. More precisely, meta reviews demonstrate that in more than half of the studies the construct does not produce the hypothesized relationships (Karimi-Alaghehband et al. 2011; Lacity et al. 2011). In the given examples, Benlian et al. (2009) as well as Loebbecke and Huyskens (2006) find no significant relationships, Dibbern et al. (2005) obtain partly significant relationships, and Aubert et al. (2004) find a significant *opposite* hypothesized relationship regarding their multi-faceted construct. The authors partly explain the low impact of asset specificity by the "definition and operationalization" of the variable (Loebbecke and Huyskens 2006, p. 421), and "measurement problems" (Aubert et al. 2004, p. 929). We put forward that IS specificity can be decomposed into three major factors referring to functional, human, and technical categories. This conceptualization is based on the idea that an IS is gradually 'made specific' while it is embedded in its organizational and technical context, so that the facets of IS specificity mutually influence each other.

Functional Specificity The core role of an enterprise IS is to provide certain functionalities that typically map to one or several business processes of an organization (O'Brien 2005). Since organizations are inherently different, packaged applications, such as ERP, typically do not perfectly match the organizations' process, data and user requirements (Sia and Soh 2007; Soh et al. 2000; Strong and Volkoff 2010). Strong and Volkoff (2010) emphasize that two different kinds of misfits can arise: *deficiencies* which result from required functionality that is actually missing, and *impositions* that arise from additional functionality that organizations implement to enable new work practices ('best practices'). The former (deficiencies) are typically overcome by adapting the application to the organization, which can vary strongly in the degree and effort put into it. Glass (1998) differentiates customization (or configuration), extension, and modification. We pose that the degree of adaption to company specific requirements directly expresses the degree of specificity of the overall IS inasmuch as a highly customized system according to our definition can be less easily *redeployed to an alternative user organization without sacrifice of its productive value.*

Important to note, customizations are not limited to conventionally deployed IS. Although SaaS applications inherently comprise a very standardized set of functionalities, vendors increasingly provide ways to enable self-service adaptation and extension, e.g. through web-based configuration (instead of editing local configuration files), use of components from platform markets (instead of locally installing add-ons) and integration through standard application programming interfaces (APIs) (Bezemer and Zaidman 2010; Sun et al. 2008; Xin and Levina 2008). For example—just like in any other software implementation project—SaaS consultants typically write up a 'requirements specification' document, which can take few days or up to several months depending on the specific case (Winkler and Günther 2012). We argue that this degree of functional specificity has both organizational and technical implications. As our first hypotheses, we pose:

H1: *Higher functional specificity of an IS leads to greater human asset specificity,* and

H2: *Higher functional specificity of an IS leads to greater technical specificity.*

Human Asset Specificity According to Williamson (1981, p. 555), human asset specificity is associated with an organization's work routines and primarily "arises from learning by doing". For example, although programming skills may be improved by practice, they are still regarded as less specific inasmuch as they are equally valued by the current and potential other employers. In contrast, the knowledge of a firm's business process is regarded as highly specific as it cannot be instantly transferred to other organizations. Functional specificity may lead to greater human asset specificity (H1), since the work routines that are created in overcoming information system misfits, i.e. through both customizing the application to own routines *and* enabling new routines, will also require greater firm-specific knowledge. In other words, in the process of specifying and customizing new software to an organization, those additional functionalities that are added to the software also require greater knowledge and skills from users. This knowledge comprises "knowledge of unique business processes and application software that is specifically customized to a company" (Dibbern et al. 2005). Such skill requirements could be reflected, for example, in the amount of user trainings given and the need to specialize and educate staff for managing this application.

The degree of human asset specificity of an information system (i.e., the application including its users and personnel responsible for its management), in turn, is likely to affect the mode of application governance. The more company-specific knowledge is incorporated in an information system, the more involvement of those organizational units is expected that make use of the information system—which are commonly the business units. Or, from a TCT view, highly specific knowledge needs to be "embedded in a protective governance structure" to economize on transaction costs for acquiring and maintaining this knowledge (Williamson 1981, p. 563). Altogether, this argument implies that more customized and functionally specific applications cause higher IS human asset specificity and therefore more *business involvement* in application-related decision authority and task responsibility. Accordingly we pose that

H3: *Higher human asset specificity of an IS leads to greater business unit application governance,* and

H3′: *Human asset specificity mediates the effect of higher functional specificity on greater business unit application governance.*

Technical Specificity Technical specificity has been considered explicitly by few IS researchers (e.g., Loebbecke and Huyskens 2006) and has thus so far only been weakly conceptualized. However, we may relate this dimension to physical specificity, generally referred to by (Williamson 1979) as *the use of special equipment or tools in an organization to produce certain goods or services.* Increased functional specificity of a business application may also lead to higher technical specificity (H1) since some functionality may require a special technical implementation. For example, in the case of a SaaS CRM implementation, a company built a special buffer-acknowledge database to exchange data, such as offers, orders, bills, delivery receipts, products and prices, in both ways between the CRM and the ERP systems (Winkler and Günther 2012). In the view of TCT, such technical integration approaches reduce the possibility of the IS to be *redeployed to alternative user organizations.*

For conventionally deployed information systems, technical specificity may refer to a number of different categories, e.g. the need of specific custom programming, databases, and server infrastructure. In a SaaS context, where the gross of technology is outsourced, the technical dimension largely refers to the integration with other backend systems (Benlian et al. 2009; Bezemer and Zaidman 2010; Sun et al. 2007). Thus, for SaaS, we might also term this construct simply as *integration specificity.* Arguably, higher technical (integration) specificity might be related with stronger application governance through IT units to minimize internal coordination costs. For example, in the given case the technical interfaces created "some discernible efforts also for the ERP team" (Winkler and Günther 2012). Altogether this adds an argument to our conceptual model that greater functional specificity also increases technical specificity, which in turn leads to more *IT* involvement in application-related decision authority and task responsibility. Accordingly we pose

H4: *Higher technical specificity of an IS leads to greater IT unit application governance,* and

H4′: *Technical specificity mediates the effect of higher functional specificity on greater IT unit application governance.*

Scope of Use

Scope of use relates to the frequency construct in TCT and can be understood as the *breadth to which a business application is used within an organization.* This scope may be expressed by the share of users of an application or simply by the amount of organizational units in which it is utilized (e.g., on a scale from single-department to company-wide use). This construct does not relate to any of the six categories of system usage provided by Burton-Jones and Straub (2006), since it captures 'lean' system usage characteristics on the organization, rather than on the individual level.

As (Karimi-Alaghehband et al. 2011, p. 135) note, some IS studies that use TCT as a theoretical lens do not account for the frequency construct and/or its interaction effects. In line with TCT, we assume that scope of use acts as a moderator (or more precisely multiplicator) of the effects of functional specificity on coordination cost imposed by both human asset and technical specificity. This is, while functional specificity leads to according human asset and technical specificity, the strengths of these relationships are influenced by scope of use. Consider the examples from above: a highly customized system will require more user trainings, whereas the need for such trainings logically still increases with the number of users that actually need to be trained. Same applies to technical specificity: the highly customized CRM system causes certain initial as well as continuous integration efforts, i.e. technical specificity. These efforts would be arguably even higher, the more employees use the system, e.g. since more data needs to be handled and more change requests turn up. Accordingly we derive that

H5: *Scope of use moderates the relationship of functional specificity and human asset specificity.*

H6: *Scope of use moderates the relationship of functional specificity and technical specificity.*

5.4.5 Methodology

To test the proposed research model, we used data from a survey with 76 organizations that provided information about a SaaS application in use. In the following we describe our approach for the development of the measurement instrument and acquisition of the sample.

Instrument Development

Our approach for developing the measures has been oriented in the procedure propounded by (Churchill 1979). The domains and subdomains of application governance and IS specificity had been initially described and specified in course of a number of explorative case studies presented elsewhere Winkler and Günther (2012). We compared these case findings with the extant literature and derived a number of items for each of the six presented constructs (plus further constructs not included in this research). In this manner, items for functional specificity (Benlian et al. 2009), human asset specificity (Dibbern et al. 2005) and decision authority (Weill and Ross 2004a) have been derived from literature, while items for technical specificity, task responsibility and scope of use can be regarded as entirely new measures. In order to validate these measures, we first conducted a category sorting with 8 fellow researchers, who had to assign the items according to given construct definitions, and eliminated ambiguous measures.

Second, we conducted an online pretest with 29 IT professionals from industry, consulting and research, which resulted in acceptable construct reliabilities (alpha>0.8). Due to size constraints for the final questionnaire, we needed to further reduce the number of items to 3 for five-point-scaled and 2 for seven-point-scaled items. Five-point scales were used for business/IT application governance items (question: who decides / who is responsible; scale anchors: busines, business with IT involvement, business and IT equally, IT with business involvement, central IT) due to their adequate semantic granularity discussed in related works (Brown and Magill 1994; Winkler et al. 2011a). Seven-point scales (very low, low, low-medium, medium, medium-high, high, very high) were used for the other measures. The final questionnaire has been pretested in think-aloud meetings with 3 different CIOs and passed only minor revisions. The measurement items are provided in Appendix 8 (page 269.

Sample Description

The survey was sent out to 2,886 large-sized companies in Germany (i.e., companies with >50 m Euros of revenues, >500 employees, from non-public sector) accompanied by a formal invitation, a return envelope, as well as references to the online version of t7he questionnaire and the project website. Relevant addresses and CIO contacts had been retrieved from a commercial publisher of company information. Besides providing the survey results, we were able to offer a small gadget for the first 100 respondents and the drawing of a tablet computer as further incentives. During a six-week response period in April/May 2011, we received feedback from total 534 companies, out of whom 220 provided usable responses (60% online, 40% paper-based, total response rate 7.6%). In the main part of the questionnaire, the respondents were asked to provide details about one business application they are knowledgeable about. 131 of these respondents provided information about a conventional application, and 76 about a SaaS in use (13 were discarded from further analyses due to unclear application types or inconsistent answers). Regarding the SaaS subsample, respondents stated to be CIOs (27.6%), senior IT managers (39.5%), IT managers (23.7%), IT staff (2.0%), and senior business managers (6.6%) with an average 12 years of work experience in their current firms (median 10 years). T-tests revealed no response bias in the model variables neither regarding business versus IT roles, nor regarding early versus late responses. The respondents provided details about a wide range of common SaaS application types, in line with the categories introduced earlier[7], these can be characterized as ERP (13), CCC (12), CRM (10), SCM (6), HRM (5), MES (4), business intelligence and analytics (6), office and productivity (5), service management (3), and other (12) application types.

5.4.6 Analysis

For the purpose of model tests we employ partial least squares (PLS), a widely used structural equations modeling technique. The choice for PLS was primarily motivated by the explorative character of this research including various new constructs as well as the good ability of PLS to handle moderating effects (Chin 1998b; Hair et al. 2011). In order to isolate the effects constituted by adding scope of use as an additional TCT construct, we test three variants of the proposed research model separately: M1 contains only the core constructs, i.e. functional specificity (FuncSp), human asset specificity (HumSp), technical specificity (TechSp), as well as application governance (AppGov), decision authority (DecAuth) and task responsibility (TaskResp) and suffices to analyze the core model including the hypothesized mediation effects. M2 integrates the scope of use (Scope) and its direct effect on HumSp and TechSp. M3 uses a product indicator approach (Henseler and Chin 2010) and includes the interaction terms (i.e., the Cartesian product indicators of Scope×FuncSp and Scope×TechSp) to test the hypothesized moderating effects. Significances were assessed based on the pseudo t-values from a bootstrapping procedure with 1,000 re-samples. We follow the recommended approach to assess the measurement model and structural model separately (Chin 1998b).

Measurement Model

We use M2 to assess the psychometric adequacy of our measurement instrument since this model variant contains all relevant indicators (i.e., includes Scope). Convergent validity of the first order constructs is supported by acceptable values for Cronbach's alpha (alpha>0.8), composite reliability (CR>0.7) and average variance extracted (AVE>0.5), see Table 5.10 (Hair et al. 2011). Furthermore, all indicator loadings are significant and clearly over the threshold of 0.7, see Appendix 8 (269). This suggests that the indicators are sufficiently correlated and reflect the properties of their substantive constructs. For the reflective second-order construct (AppGov), convergent validity can be assessed by calculating the AVE of its subdimensions (MacKenzie et al. 2011, p. 315). With two highly significant path coefficients to DecAuth (.920, R^2=.847) and TaskResp (.936, R^2=.877), see Table 5.11 (page 193), this second-order AVE amounts to highly an acceptable AVE of .862.

Table 5.10: Measurement model validity

Operationalization				Convergent validity			Discriminant validity ($\sqrt{AVE}$ on diagonal)					
Construct	Items	Dim	Scale	Alpha	CR	AVE	1	2	3	4	5	6
DecAuth	3	B/IT	1-5	.836	.902	.754	**.868**	–	–	–	–	–
TaskResp	3	B/IT	1-5	.915	.946	.854	.724	**.924**	–	–	–	–
FuncSp	2	−/+	1-7	.878	.943	.891	.229	.095	**.944**	–	–	–
HumSp	2	−/+	1-7	.885	.946	.897	.042	.011	.533	**.947**	–	–
TechSp	2	−/+	1-7	.830	.922	.854	-.008	-.010	.486	.731	**.924**	–
Scope	2	−/+	1-7	.779	.889	.802	.506	.426	.543	.310	.342	**.895**

1: Decision authority; 2: Task responsibility, 3: Functional specificity; 4: Human asset specificity, 5: Technical specificity; 6: Scope of use

We analyze discriminant validity by the Fornell-Larcker criterion, indicator cross-loadings, and an exploratory factor analysis (EFA). Fornell and Larcker (1981) suggest that the squared latent variable correlations should be less than AVE for each construct to ensure support validity, which is the case for our model, see Table 5.11. Indicator cross-loadings are as well lower than loadings by their substantive constructs, see Appendix 8 (page 269). However, we note that some loadings within the application governance domain, as well as within the IS specificity domain are above the threshold of 0.7, indicating that—statistically—these cannot not necessarily be viewed as separate dimensions. After varimax rotation, the EFA of our model variables (eigenvalue>1; KMO=.816) yields three clearly distinguishable factors relating to the indicators of application governance (30.8% of explained variance), IS specificity (24.15%), and scope (17.49%). This supports our nomological framework inasmuch as we stated that both DecAuth and TaskResp are subdimensions of application governance. Likewise, FuncSp, HumSp and TechSp can be viewed as components of overall IS specificity (which, based on our particular research interest, has not been explicitly modeled here).

Finally, we assess common method bias (CMB) by using a latent method factor approach for PLS. Especially in self-reported data where independent and dependent variables stem from the same source, CMB may arise due to the subjects' motif to give consistent and/or socially desirable answers (Podsakoff and Organ 1986). Following the procedure described by Liang et al. (2007, pp. 85-87), we add a method factor to the model to account for this bias and compare the average variance presented by this factor with the variance presented by the substantive constructs. To account for each indicator only once, we omit the reflective first-order constructs and test the method influence directly on the six indicators of AppGov. The method factor accounts for .009 of the average variance while the substantive constructs explain .799 (ratio 1:88), suggesting that CMB is unlikely to affect our results.

Table 5.11: Model tests

H	**Path**	**M1** (mediation model)		**M2** (including Scope)		**M3** (moderated med.)		**Sup-port**
		coeff[a]	f^2	coeff[a]	f^2	coeff[a]	f^2	
–	FuncSp→AppGov[b]	-.010^{ns}	-.017	-.015^{ns}	-.002	-.015^{ns}	-.002	–
H1	FuncSp→HumSp	.736**	–	.691**	.415	.559**	.474	Sup.
H2	FuncSp→TechSp	.541**	–	.404**	.141	.319**	.167	Sup.
H3	HumSp→AppGov	-.105^{ns}	.008	-.121*	.006	-.120*	.011	Part.
H3′	FuncSp→HumSp →AppGov[c]	-.077^{ns}	.878	-.084*	.852	-.067*	.819	Part.
H4	TechSp→AppGov	.235**	.042	.229**	.038	.228**	.040	Sup.
H4′	FuncSp→TechSp →AppGov[c]	.128**	1.086	.094**	1.186	.073**	1.258	Sup.
–	Scope→HumSp	–	–	.128**	.007	-.031^{ns}	.066	–
–	Scope→TechSp	–	–	.419**	.150	.313**	.175	–
H5	Scope×FuncSp →HumSp	–	–	–	–	.338**	.058	Sup.
H6	Scope×FuncSp →TechSp	–	–	–	–	.222**	.025	Sup.
–	AppGov→DecAuth	.922**	–	.920**	–	.920**	–	–
–	AppGov→TaskResp	.937**	–	.936**	–	.936**	–	–

[a] *p<.05; **p<.01; ^{ns}not significant
[b] direct path for comparison and VAF calculation, not included for further model tests
[c] total mediated effect, significance according to Sobel test (1982), VAF reported instead of f^2

Structural Model

The results of the structural model tests are provided in Table 5.11. Path coefficients and significances can be interpreted similar to coefficients in a simple regression; effect sizes f^2 express the relative change in the explained variance of an endogenous construct when eliminating one of its antecedent variables from the model (Chin 1998b, p. 317).

Analogously to regression analyses, effect sizes of 0.02, 0.15, and 0.35 can be regarded as small, medium, and large, respectively (Cohen 1988, p. 421). For the mediation effects, we report the *specific indirect effect* (i.e., the product of the path coefficients of the mediation) (Hayes 2009, p. 3) and its significance assessed by a Sobel (1982) test statistic; in the effect size column, we alternatively report the *variance accounted for (VAF)* of the specific indirect effect relative to the *specific* total effect (i.e., the total effect *excluding* the opposite mediation effect).[10] In simple mediation models, values for VAF range from of 0.0 (no mediation) to 1.0 (perfect mediation), while values greater than 1.0 demonstrate a suppressor effect (Shrout and Bolger 2002, p. 430). In the following, we will evaluate our hypotheses successively.

Worth to begin with, we find that the direct effect from FuncSp to AppGov is close to zero and not significant (for none of the model variants). The effect size of FuncSp is even negative, which shows the rare case that excluding this construct from the model even increases explained variance in AppGov. (This will be explained more in detail in the following.)

The paths FuncSp→HumSp and FuncSp→TechSp are both strongly significant, which confirms H1 and H2 and underlines the nomological argument made earlier that these constructs are ultimately dimensions of an overall IS specificity property. When including Scope and interaction variables in M2 and M3, we note that the strength of both paths decreases only moderately so that support for these hypotheses is sustained. Accordingly, the effect sizes of this construct compared to the influence exerted by Scope are considerably strong.

We find partial support for H3 and the path HumSp→AppGov. This is, in the simple mediation model (M1) the path is negative as hypothesized, yet, not significant at the 0.05 level (t=1.573). However, when adding Scope and the interaction variable to the models M2 and M3, the path coefficient increases slightly and becomes statistically significant (t=1.777). We take this as evidence that including the Scope variable increases the overall explanatory power of the model, although the effect sizes presented by HumSp remain extremely weak. Similarly, we find that HumSp significantly mediates the effect from FuncSp through AppGov (H3′) when Scope is included into the model (M2 and M3). The high VAF ratio (>0.8) expresses that this mediation effect is comparably strong to the non-existent direct effect (FuncSp→AppGov).

Analyzing the role of TechSp, we find also support for our hypotheses H4 and H4′. TechSp has a clear and significant impact on AppGov across all three model variants with small, but considerable effect sizes. Furthermore, as hypothesized, TechSp significantly mediates the effect from FuncSp to AppGov *in opposite direction* to the mediation exerted by HumSp. Thus, we find an explanation *for why* there is no direct effect from FuncSp to AppGov: While HumSp *negatively* exerts the effect from FuncSp on AppGov, TechSp

[10] Hayes (2009, p. 14) adds for consideration that "the quantification of effect size in intervening variable models remains a cutting-edge area of thinking and research" where "none of the methods proposed thus far are particularly satisfying." Since total effects can approach zero and even have opposite signs than the denominator, any 'VAF ratio' of a mediation effect should be interpreted with caution.

positively counteracts it. For this reason the total effects (i.e., the sum of the direct and indirect effects) are close to zero across all three model variants. Or in the words of Hayes (2009, p. 10), we provide a case where "two or more indirect effects with opposite signs can cancel each other out, producing a total effect and perhaps even a total indirect effect that is not detectably different from zero."

Regarding the hypothesized moderating effects and the product indicator approach, we first add Scope as a second antecedent of HumSp and TechSp to the model (M2). This yields in significant paths and a considerable increase in explained variance for TechSp (f^2=0.15). However, when introducing the two interaction terms (Scope×FuncSp), the coefficient Scope→TechSp is reduced and Scope→HumSp is practically absorbed. Coupled with the finding that the interaction terms are significant for both relationships (with considerable effect sizes), we can say the moderating hypotheses H5 and H6 are both supported, which underlines the explanatory power provided by the 'scope of use' construct.

Multidimensional Scaling of Application Types

To provide a more visual interpretation of our results, we perform a multidimensional scaling (MDS) of application types and a property fitting according to the model dimensions. Multidimensional scaling refers to set of analytical techniques that aim to explore multidimensional data by positioning objects in a low-dimensional space based on their similarity (or dissimilarity) characteristics (Kruskal and Wish 1978; Kappelhoff 2001). Objects in our case refer to the different application types by which respondents classified their SaaS application (see 5.4.5). Based on the standardized factor scores from the PLS analysis, we first calculate the factor means for each of the six model variables (i.e., FuncSp, HumSp, TechSp, Scope, DecAuth, and TaskResp) per application type, see Table 5.12. Based on these factor means, we generate six dissimilarity matrices (one per factor) by calculating the pairwise absolute differences between the factor means. These dissimilarity matrices are used as an input for a MDS with two dimensions, an euclidean metric and interval scales[11].

As a result, we obtain the (x, y)-values of the final MDS solution (see Table 5.12) and a scatter plot of the 10 application types (see Figure 5.9). The STRESS of this final solution is 0.177, i.e. (1−STRESS)=82.3 percent of the scaled data can be accounted for by the MDS procedure, which can be regarded as a good level of fit (Kappelhoff 2001). Trying to interpret this chart (still without the dimensional lines), we find a cloud of almost equidistant application types in a two-dimensional space, with *HRM* and *other* solutions at the left end and *SCM*, *ERP*, and *M*ES types at the other, as well as *productivity* applications at the far outer right margin.

Inevitably the question arises, how these positions can be explained against the background of the pertinent properties of these applications types (i.e., FuncSp, HumSp, TechSp, and Scope) and the governance outcomes we proposed earlier (i.e., DecAuth

[11]Stop criterion is gradient of STRESS<.0001

Table 5.12: Application types (factor means and scaling results)

Group		**Factor means**						**Position**	
Type[a]	n	FuncSp	HumSp	TechSp	Scope	DecAuth	TaskResp	x	y
BI&A	6	-.356	-.130	-.081	.072	-.180	-.002	-.201	.035
CCC	12	-.378	-.437	-.081	.236	.504	.499	-.047	-.449
CRM	10	.310	.315	.042	-.070	-.596	-.333	-.092	.411
ERP	13	.253	.503	.202	.360	.292	.101	.319	.127
HRM	5	-.358	-.193	-.899	-.595	-.703	-.583	-.788	.003
Prod	5	.705	.552	.793	1.096	.804	.854	.987	-.195
MES	4	.677	1.067	.806	.792	-.062	.075	.723	.377
SM	3	-.312	-.010	-.445	-.284	.597	-.286	-.358	-.223
SCM	6	.198	-.349	.534	-.387	.267	.393	.204	-.253
Other	12	-.325	-.633	-.513	-.813	-.546	-.525	-.746	.165

[a] BI&A: Business Intelligence and Analytics, CCC: Content, Communication and Collaboration, CRM: Customer Relationship Management, ERP: Enterprise Resource Planning, HRM: Human Resource Management, Prod: Productivity and office applications, MES: Manufacturing Execution Systems, SM: Service Management, SCM: Supply Chain Management

and TaskResp). Property fitting provides a way to visualize and interpret previously assessed dimensions in MDS. Following the procedure described by Kappelhoff (2001, pp. 64-69), we perform linear regressions of the (x, y)-values on each of the specificity and governance dimensions. The resulting coefficients can be translated into gradients of the plotted dimensional lines ($y = ax$) by a division ($a = \frac{c_x}{c_y}$), intercepts can be omitted. Figure 5.9 illustrates how these lines are situated in our two-dimensional space.

For the purpose of interpretation, the (average) properties of each application type can be assessed by drawing an orthogonal line (i.e., 'dropping a perpendicular') on the dimension of interest (therefore intercepts are not relevant). We may exemplify this by *SaaS ERP systems*, see dashed lines in Figure 5.9. According to our data, SaaS ERP systems exhibit an above-average human asset specificity (HumSp) as well as a above-average technical specificity (TechSp). Since the correlation (or influence) of TechSp on the governance dimensions is reasonably stronger for TechSp, in sum these specificity characteristics lead to a slightly more IT-oriented governance outcome (here the perpendicular on TaskResp is depicted). Thus, this graphical interpretation is largely consistent with the factor mean values provided in Table 5.12 (i.e., HumSp=.503; TechSp=.202; TaskResp=.101).[12] In contrast, for example, *SaaS Human Resource Management (HRM)* solutions exhibit far below-average functional, human asset, and technical specificities and are therefore largely governed by business stakeholders. Apparently the same applies to the the bunch of solutions classified as *other applications* by our respondents.

This visualization also expresses the relationships of the specificity and governance dimensions as a whole. First, we note that the FuncSp dimension itself is almost orthogonal to the TaskResp and DecAuth lines. That is, increasing (or decreasing) the functional

[12] Note that the dimensions do not perfectly scale, i.e. due to the aggregation in a two-dimensional space there is an average STRESS=17.7% error in the the prediction of this graphical interpretation.

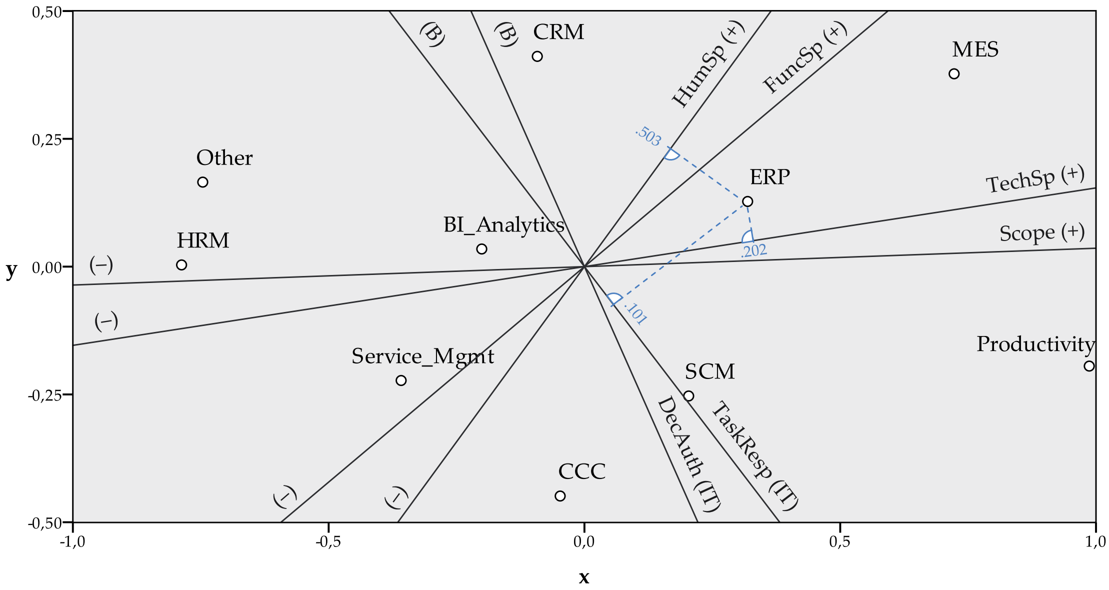


Figure 5.9: Multidimensional visualization of application types (including specificity and governance dimensions

specificity of an application is unlikely to affect these application governance outcomes (since the intersection with the perpendicular remains the same). However, in line with our nomological framework, increasing FuncSp regularly also increases the HumSp and TechSp, which are *not* perfectly othogonal to the governance dimensions. Rather, HumSp correlates with more business involvement (acute angle towards Business) while TechSp stongly correlates with IT involvement (acute angle towards IT). This visualizes how and why the impact on the application governance dimension may vary. A greater *Scope* of use, in this sense, can be viewed as a moderating influence which increases the correlations between all the mentioned variables, practically by 'pushing' an object (i.e., the application) to a more outer (or inner) 'orbit' within this spacial model.

5.4.7 Discussion

This work was motivated by the principal argument that the fundamental characteristics of 'ensemble' information systems (IS) are not yet sufficiently understood, so that we still fall short in explaining individual application governance outcomes. We employed a transaction cost theoretic lens and hypothesized that different components of IS specificity (i.e., functional specificity, human asset specificity, and technical specificity) lead to different and partially contrary application governance patterns. Our hypotheses are grounded in the rationale of organizational and technical embedding. That is, enterprise IS (including packaged applications as well as SaaS) are typically first functionally specified before they are technically implemented and taken in use in an organizational context.

We find empirical evidence for our argument that greater technical embeddedness (represented by technical specificity) leads to greater IT involvement in application-related decisions and tasks (H2, H4, H4′), while greater organizational embeddedness (represented by human asset specificity) is likely to induce more involvement of business units (H1, H3, H3′). This unveils a theoretically interesting, and practically relevant new dualism regarding the contradictory role of IS specificity for explaining governance phenomena. Furthermore, we find strong support for the relevance of considering the scope of use of an IS as a moderator in these relationships. Consequently, the more employees use an IS, the greater is the impact of the systems functional specification on both the extent of organizational *and* technical embedding of the IS—and thus the need to define appropriate governance arrangements. We see three major directions of theoretical impetus provided by this research.

Contribution to IT Governance Theory

Our findings contribute to past research on IT governance since they reconfirm the need to balance decision rights between different stakeholders involved in IT related decision making (e.g., Brown 1997; Brown and Magill 1994; Sambamurthy and Zmud 1999; Weill and Ross 2004a). In addition to stressing the *need* for balancing decision rights and proposing appropriate new governance dimensions—i.e. decision authority and task responsibility between business and IT units—this research provides reasons for *why* application governance arrangements vary. We find these reasons (at least partly) in the specificity characteristics of different information systems. This represents a new contribution inasmuch as (a) this is (to the knowledge of the authors) the first work to employ a purely transaction cost theoretic (TCT) lens for investigating *internal* IT governance phenomena (i.e., excluding outsourcing). TCT thus emerges as a particulary valuable lens to capture the different facets of IS specificity that play a role in IT governance contexts.

(b) Past IT governance research has focused on business related contingencies (such as firm strategy, size and diversification) and thus largely neglected the *technological antecedents* (Brown and Grant 2005, p. 704). Just more recently, authors have emphasized the *complementarities* between the technical and organizational architecture (Tiwana and Konsynski 2010). Thus, our findings add a new dualism to this complementary view. (c) As a result, we particularly advance in the understanding of IT governance phenomena on the *application level*. Such modular view, i.e. disaggregating 'the bulk IT function' along its technological architecture, appears long overdue given the increasing dispersion of information systems within, and outside of, organizational boundaries.

Contribution to Transaction Cost Theory in IS

We put forward, that our appropriation of TCT to an IS context, and particularly the distinctive view of IS specificity as a construct composed of different facets, may also provide a valuable lens to address other IT governance phenomena, particularly related to IS outsourcing. In line with Williamson (1979; 1981; 1985; 1991; 1996), we argued that application-related transaction costs (or better: *coordination costs*) can arise from different types of assets (here: functionality, human assets, and technological integration). However, in contrast to Williamson we do *not* argue that *one* single form of governance (e.g., hierarchical coordination) is optimal to economize on *all* types of coordination cost. Instead, we argued that, for example, costs arising from human asset specificity are economized through business coordination while costs arising from technical specificity are economized through stronger IT coordination.

This proposition is in line with prior organization researchers who have emphasized that different kinds of transaction cost can arise from the possible forms of governance (Hennart 1993). While this seems to be a very simple logic, such multi-faceted understanding of IS specificity might provide a new key to resolve some of the inconsistencies regarding past TCT research in studying IS outsourcing phenomena (Karimi-Alaghehband et al. 2011; Lacity et al. 2011). Transferring our logic (back) to the domain of IS outsourcing, this could imply that human asset specificity is handled more efficiently under hierarchical coordination (i.e., in-house) while (at least some aspects of) technical specificity can be handled better through market coordination (i.e., by providers who are potentially more specialized to economize on production costs *and* technical coordination costs). The presented examples from the TCT/IS outsourcing literature (Benlian et al. 2009; Dibbern et al. 2005) provide at least a first indication for this argument. In contrast, aggregating a multitude of facets into a single dimension, as in (Aubert et al. 2004), potentially just aggravates the prevailing ambiguities around asset specificity in an IS context.

As a way forward, future TCT/IS studies might consider the issue of multidimensionality of the IS specificity construct. Researchers might also revise past data in this regard, and thus exploit the body of "empirical IS studies carried out on IT outsourcing over the last nearly 20 years" (Lacity et al. 2011, p. 148). This perspective, however, contradicts the immediate claim to "discard constructs from reference disciplines that have not been empirically robust in the ITO context, like asset specificity from [TCT]." (Lacity et al. 2011, p. 149). The aim of this study was rather to provide a way for a better *appropriation* of this reference theory to the IS field (Karimi-Alaghehband et al. 2011). In this sense, we also demonstrated how we can interpret the frequency construct in an IS context as a *scope of use*. Ultimately, by this we expect a better understanding of IT 'artifact' specificity, its interaction with other TCT variables, and its impact on (internal *and* external) coordination mechanisms. Such understanding may be particularly helpful in the beginning era of SaaS and Cloud computing (Bento and Bento 2011; Khajeh-Hosseini et al. 2010).

Contribution to Theories of the IT Artifact

We believe that our distinct approach also allows us to position our findings in a wider context regarding the conceptualization of the IS/IT artifact. Since the call from Orlikowski and Iacono (2001), IS researchers have widely debated about conceptualizations of the IT artifact (e.g., in King and Lyytinen 2006). Strong and Volkoff (2010) theorize on a conceptual model originally propounded by Wand and Weber (1990), which characterizes the IT artifact to consist of deep, surface, and physical structures. Surface structures represent the facilities that allow users to interact with the system, i.e. the user interface and its usability criteria. Deep structures represent things, properties, states and transformations of real-world systems, i.e. functionality and data, and physical structures refer to the underlying technology. Some readers may also recognize these elements as presentation, logic, data and hardware layers in software engineering (e.g., Fowler 2003, pp. 17-24).

Strong and Volkoff (2010) extend this conceptualization by a fourth element that they refer to as “latent structures” containing roles and control—which we may consider as core elements of IT governance—as well as organizational culture. As the authors argue, “the latent structures emerge from and depend on the other three structures”, or in other words, the arrangements for governing and managing IT artifacts are inherently related with the usability, functionality, data, physical configuration, and potentially other properties of an IS. However, even studies taking an ensemble view “focus on what the technology is connected to, while black-boxing the structures that constitute the technology itself”, as the authors continue (Strong and Volkoff 2010, p. 752).

The study by Strong and Volkoff (2010)—which can be regarded as a type II theory, according to the taxonomy by Gregor (2006)—makes a valuable point by postulating an integrated ensemble view of latent structures *and* the IT artifact. However, it falls short in developing testable propositions to “learn to design [such] latent structures” as the authors acknowledge (p. 752). We suggest that the dimensions of IS specificity set forth in our study (foremost functional and technical specificity) can be well regarded as measurable properties of the deep structures of an IS, while the dimensions of application governance clearly relate to the *latent* structures. In this sense, our study provides first causal explanations *and* tested propositions on the relationship of deep and latent structures. This, we argue, also advances our understanding of ‘IT artifacts’ from a type II towards a type IV theory (Gregor 2006).

Practical Implications

This research also provides relevant insights for practitioners, both in business and IT positions. First, our model facilitates a contingent understanding on how management and governance patterns for single applications depend on the type of application itself. Taken the examples from the outset, this would mean that the management of conventional ERP systems is best organized in central IT competence centers due to their high functional and technical specificity (Kræmmergaard and Rose 2002). In contrast, emerging social software tools can, and potentially should, be given to the hands of business stakeholders, since/if they are operated as largely isolated applications (i.e., technically unspecific) and deal with highly company-specific knowledge (i.e., human asset specificity) (Deans 2011).

As our data was based on the assessment of various *SaaS* applications, the results particularly provide a rationale on how to design such governance arrangements in the 'Cloud' era. Based on a multidimensional scaling, we provide a novel visualization of different SaaS application types that aggregates all relevant model dimensions within a single diagram and can be used to infer from the specificity characteristics of an application to its governance dimensions. Such simple, yet meaningful, visualization provides a useful overview and thus a comprehensive understanding of the pertaining characteristics of different application types. Our hope is that this model may also be used to guide practical decision making across diverse SaaS adoption and governance contexts.

Consequently, under some conditions (i.e., low technical specificity and scope, and high human asset specificity) this may imply to grant more decision rights to business stakeholders and thus manage an increasing number of decision rights dispersed across the organization. For some CIOs, to loosen the imperative of 'strictly centralized' IT control known from many traditional enterprise IS, may well represent a paradigm shift. On the other hand, business practitioners may find our insights helpful to realize that even for SaaS, not only in case of high technical integration, some coordination with IT units remains a key necessity. Thus, altogether our 'dualist' view strengthens the importance of *aligning* IT with business (and vice versa), all the more in the era of Cloud-based computing.

Limitations and Future Work

Three limitations of this study merit consideration, foremost related to issues of operationalization, generalizability, causality and endogeneity. First, due to practical restrictions, we operationalized constructs with a comparably low number of items. Arguably, a semantically broader operationalization may have improved predictive validity of our research model (Diamantopoulos et al. 2012). Second, our sample is based on data from large-sized enterprises in Germany using SaaS applications. Thus, any generalization to any other macro and micro context is purely argumentative. Third, the cross-sectional analysis can only ascertain association, not the causal ordering that derives from our theoretical argument. Conversely, governance arrangements may also influence specificity characteristics of the ensemble information system that was subject of this research.

We see multiple directions for further research. First, as the conceptualization of the IS specificity construct is still in an exploratory phase, future works may unveil further subdimensions and develop semantically broader measures. According to the presented conceptualization of the IT artifact, deep structures (e.g., data) and surface structures (e.g., usability) represent promising characteristics that could be dimensionalized in a higher-order theoretical model. In addition, as suggested earlier, researchers in the IT outsourcing field might find it helpful to reconsider the demonstrated multidimensionality of IS specificity to isolate further potentially opposing effects. Finally, future works should also address the question in how far the proposed dualism, besides for SaaS, also holds for the domain of traditional delivery models. As we motivated at the outset, a comprehensive understanding of IS specificity might provide a way to unite the important, yet separate research streams of internal IT governance and external outsourcing governance, towards a broader understanding of IT governance phenomena in expanding IT landscapes.

5.4.8 Summary

This chapter addressed the theoretically neglected role of information systems (IS) specificity for application governance, by referring to the allocation of application-related decision authority and task responsibility between business and IT units. Based on the premise of organizational and technical 'embedding', and employing a transaction cost theoretic (TCT) view, we developed the idea that customization and greater functional specificity of an IS lead to both more business authority through higher human asset specificity and more IT authority through higher technical specificity. Survey data from 76 organizations using different types of software as a service provide support for these ideas. Our results unveil a new dualism for explaining IT governance phenomena on the application level. Furthermore, we demonstrated a relevant appropriation of the frequency construct from TCT to this context and provided a visualization that may guide managerial decision making in diverse SaaS adoption and governance contexts. Besides practical implications, we outlined contributions to IT governance, transaction cost, and IT artifact theories in the IS field.

6 Conclusion and Contributions

This thesis was motivated by the principal idea that IT governance plays an important role for adopting IT-based innovations and that this relationship has been theoretically neglected in contemporary IT governance research. I conducted eight studies with diverse municipal governments and enterprises to investigate IT governance challenges regarding two recent IT-based innovations: Mobile Government (M-Government) and Software as a Service (SaaS). The particular focus of these studies was on the question of how the locus of authority for IT decisions influences, or is influenced by, technology adoption. Furthermore, the studies give concise theoretical insights on each of these specific adoption contexts and aim to provide practical guidance for making governance and adoption decisions. In the following, I will briefly summarize the results of each of these studies.

In the first study (4.1), we found evidence that there is a relationship between the strategic framework (i.e., efficiency goals, innovation goals, and IT sophistication) of a municipality and the planned use of M-Government services. We expressed a suspected heterogeneity of public agencies by four clusters describing Innovator, IT experienced, Efficiency-oriented, and Laggard municipalities. An in-depth case analysis of these types of municipalities particularizes this relationship by providing detailed evidence for the strategic (financial situation) and organizational (IT governance) contingencies that determine the extent and focus of M-Government adoption (4.2). Given the result that most municipalities still focus on internal efficiency and effectiveness (i.e., process innovations) and refrain from offering citizen-centric and transactional M-Government services (i.e., service innovations), we shed more light on the benefits of urban sensing, a particular class of mobile applications for *external* M-Government. The results of a citizen survey indicate that urban sensing can provide a means for increasing citizen participation, whereas perceived privacy risks are *not* a significant barrier to adoption (4.3). In addition, we demonstrate that such services can improve a a municipality's level of environmental information at comparable cost to internal information acquisition procedures and—in this sense—simultaneously allow for implementing a service and a process innovation (4.4).

In an enterprise context, I studied the impacts of adopting Software as a Service (SaaS) on internal IT governance. A first exploratory case analysis suggests that companies allocate authority for the same SaaS application (a well-known CRM system) in distinct, but clearly distinguishable ways, i.e. either to business or to IT units, based on certain contingent factors (5.1). Chapter 5.2 puts these factors on a broader theoretical basis and partly confirms the proposed contingency model in a cross-industry survey with large German enterprises. However, the results remain partly inconclusive regarding the influence of some of the constructs that were derived from an agency and transaction cost theoretic perspective (particularly the locus of *initiative* and application *specificity*). Addressing some of these limitations, I demonstrate a process-theoretic approach where the initiative and application specificity factors emerge as intermediate variables between the overall mode of IT governance and application-level governance outcomes (5.3). Such process view is taken as a premise for a deeper analysis of the role of information system specificity in Chapter 5.4. Finally, here we are able to unveil that the functional and technological properties pertaining to (SaaS) applications have a *dual* influence on the locus of IS authority.

I am confident that the results of this compound research allow for some overarching theoretical, practical and methodological conclusions, which I will discuss in the remaining sections.

6.1 Theoretical Contribution: On the Relationship of IT Governance and Innovation

Two principal research questions guided this dissertation, RQ1: how does the mode of IT governance influence the adoption of new technologies and RQ2: how does the adoption of new technologies affect organizational IT governance. In this context, we understood IT governance more narrowly as the *locus of IT decision rights* (Brown and Magill 1994) and adoption of IT innovations as *the decision of an organization to make use of a new technology* (Rogers 1962). At first sight, these two constructs may seem two incompatible concepts from different domains without a logical link. IT governance is often thought to prescribe a rather static set of rules and guidelines that are derived from corporate governance and fit to certain business contingencies. In contrast, IT innovation inherently deals with different technologies and a dynamic development over time. However, our argument for linking these two domains was motivated by the observation that IT organizations have historically oscillated between centralized and decentralized forms (Peak and Azadmanesh 1997; Brynjolfsson and Hitt 1998; Evaristo et al. 2005) as well as by the practical necessity to provide more guidance for organizations on how to *govern* IT innovation and technological change (Chapter 2).

Regarding **RQ1**, I particularly drew the focus on the adoption of mobile technologies in a public sector context. Both the results of a survey-based investigation as well as an in-depth case investigation prove that there is a relationship between the strategic framework of municipalities and their adoption of M-Government innovations. Important to note, this ‘strategic framework’ is composed of drivers that are less easy to change, such as the efficiency-versus-innovation dimension, or—as we put it later—the ‘financial situation’. On the other hand, it also comprises drivers that are more actionable, such as IT sophistication (referring to the institutional arrangements and technological vision for M-Government) or, as we concretized in the second study, the mode of IT governance. Regarding the latter, we provide evidence that those public agencies that are able to effectively connect responsibilities for information technology *and* organizational change also succeed in the adoption of IT-based innovations. In contrast, municipalities that fail to do so run the risk to end up with an unfocused adoption of M-Government innovations with less efficiency and greater frictions. Thus, this capability, which we termed '*transformational IT governance*', appears to be a key prerequisite to ensure successful implementation especially of process innovations in public sector.

According to our case findings, transformational governance can be achieved in different ways. For example, responsibilities for IT and organization can reside within the same organizational unit, such as in Case A in an 'office for organization and IT steering' that is subordinate to the general office for central services. Or, the office for IT steering is subordinate to the central office for (personnel administration and) organization, such as in case C. It may even be sufficient if these responsibilities are effectively aligned via appropriate governance mechanisms, such as in case B, where the staff council participates in a joint IT steering committee that meets every 4-6 weeks. However, if joint IT and organization meetings are not sufficiently empowered to make decisions, such as in case D, then alignment and governance outcomes are likely to be suboptimal from an innovation adoption standpoint. This is mainly because potential user resistances can not be effectively mitigated and overcome.

Given these examples, we find that transformational IT governance cannot be instantly mapped to the presence of a single organizational configuration or governance mechanism. However, we provide an argument that allocating IT decision rights closer to where decision rights for personnel and organization reside (which is usually *centralized*) will generally improve process innovativeness. This represents a novel finding inasmuch as it contradicts the classic rationale of *decentralizing* IT governance for greater innovation (e.g., Weill and Ross 2004b). (How much this finding can be attributed to the particular public sector context, will be the subject of the next section.) Regarding the E-Government context, the claim for transformational IT governance is largely consistent with the upcoming literature on 'transformational government' (Irani et al. 2008; Weerakkody et al. 2007). Although several authors have emphasized the importance of IT governance in E-Government, few works have made concrete propositions on how to operationalize (i.e., implement) effective IT governance in this field (Janssen and Shu 2008). Especially in the context of M-Government, the role of IT governance has remained without precise suggestions, although some "experts highlighted barriers relating to governance when initiating a mobile service project" (El-Kiki and Lawrence 2007, p. 785). Besides providing exploratory case evidence, I described very practically how different stakeholders can be aligned when launching a new M-Government service (Chapter 4.4). For this purpose, we drew on the case of the State Capital of Saarbrücken and the implementation of an urban sensing application. For these reasons, I believe that the theoretical and practical findings of this work make a particularly valuable contribution to the field of IT governance in E-Government.

Regarding **RQ2**, I hypothesized the adoption of Software as a Service and emerging Cloud-based solutions to have an impact on IT governance. This suspicion was rooted in the nature of SaaS as an (increasingly successful) external delivery model as well as in its technological differences in the way that software is provided. Conceptually, this principal hypothesis first required to conceptualize IT governance arrangements on the application-level in order to isolate the differences between SaaS and traditional delivery models. Therefore we theoretically developed the two subdimensions decision authority and task responsibility. Both an exploratory case analysis as well as a large-sample survey showed that companies (sometimes) allocate authority and responsibility for SaaS in ways that differ from traditional delivery models, i.e. with significantly more business involvement. Throughout the course of the studies, we proposed a transaction cost theoretic explanation for this finding. According to this view, companies allocate application authority between business and IT units in a way that minimizes their total IT production and IT coordination cost. For traditional delivery models, firms have a great incentive to centralize application operations to a corporate IT department to leverage internal IT production cost advantages, so that the costs of coordination remain secondary. For SaaS (as well as other outsourcing models) however, production cost advantages largely accrue on the provider side (expressed by the provider's fees). Thus, the question of internal governance becomes merely dependent on the costs incurred for coordinating application operations (also termed by Williamson as 'governance costs'). For this reason, the rationale of leveraging internal economies of scale becomes much weaker for SaaS, which in turn explains the greater decentralization of authority for SaaS.

Nevertheless, the proposed 'shift' of application governance clearly does not yield the extent that some radical proponents would presumably expect (Carr 2005). This is, the majority of SaaS applications (59.2%) is still governed in IT dominated patterns, while there is also a considerable amount of "traditional" on-premise software, which is governed in non-IT-dominated patterns (19.8%). This led us to research more into the technological contingencies of application governance, which have been largely neglected by the past IT governance literature (Brown and Grant 2005, p. 704). To qualify this, some research *has* considered the technological dimension inasmuch it conceptually separated IT decision rights for applications and infrastructure, leading to the wide recognition of the *federal* archetype (e.g., Brown 1997; Sambamurthy and Zmud 1999). However, I may argue that this separation still lacks in sufficiently capturing the technological dimension, since the border between what is an application and what is infrastructure remains blurred. We may consider two provocative examples: According to a federal governance logic, productivity *applications*, such as common office and spreadsheet programs, would be provided in a decentralized fashion by business units. Conversely, high-performance computers used for example for laboratory automation systems (Wood 2007)—in their nature as *infrastructure* artifacts—would be governed centrally by a corporate IT unit. Intuitively, this does not necessarily reflect the reality in a majority of firms. Thus, the mere knowledge of whether an IT artifact is an application or infrastructure does not appear sufficient to explain why individual governance outcomes occur.

In the last study of this thesis, we proposed that four essential constructs derived from transaction cost theory are better suited to capture the pertinent and salient characteristics of IT artifacts: functional specificity, human asset specificity, technical specificity as well as scope of use. According to this view, more business involvement is caused by human asset specificity, while more IT involvement follows from technical specificity. This dualism is grounded in a procedural view of SaaS (or generally information system) adoption. That is, information systems are gradually made (functionally) specific when being adopted in an organization, which in turn leads to both higher human asset specificity as well as technical specificity. Such procedural views are consistent with the literature on enterprise-system fit (Soh et al. 2000; Sia and Soh 2007; Strong and Volkoff 2010), and have as well been applied in a governance context (Xue et al. 2008). Our data on SaaS application governance provides evidence for this view. This suggests that the type of application (expressed by its specificity) clearly has a bearing on the mode of application governance, or more generally, that the type of IT-based innovation adopted can even influence (at least to some extent) the overall mode of IT governance.

The compound findings of this second part make three main contributions. First, as outlined above, we conceptualize overall IT governance as the sum of more modular governance arrangements on application level (here dimensionalized by decision authority and task responsibility). Second, we provide a transaction cost theoretic explanation for why the classical rationale of centralizing governance for greater efficiency and economies of scale is not necessarily applicable for external delivery models (such as SaaS). More than that, we provide some exploratory case evidence that firms seeking greater *efficiency* potentially tend to *decentralize* application governance for SaaS more than other organizations would do (Chapters 5.1 and 5.3, case B). This can be regarded at least as one example falsifying the classic strategy-structure fit for IT governance on the application level. Finally, we show how the type of IT-based innovation (characterized by different specificity dimensions) has a bearing on the particular mode of artifact-level governance, i.e. we demonstrate some of the technological contingencies.

Altogether, I argue that the findings made for both research questions enrich IT governance theory by providing novel insights and theoretic rationales regarding the mutual and *bidirectional* relationship between the mode of IT governance and diverse IT-based innovations. The main contributions of this research and how they extend existing IT governance theory are summarized in Table 6.1.

6.2 Practical Contribution: Reflections on IT Governance in Public and Private Sector

The two different innovation contexts considered in this dissertation allow us to derive a few practical guidelines for designing IT governance in public and private sector (compare Weill and Ross 2004a, pp. 185-214; Ali and Green 2007; Sethibe et al. 2007). Moreover, the described findings, i.e. the proposition of 'transformational governance' in E-Government as well as the observed 'shift' of enterprise SaaS governance from IT to business units, immediately raise the question of how far these observations also hold for an opposite sector context. In order to reflect on these questions, I will first briefly review the principal differences between public and private sector organizations before I discuss both findings separately.

Table 6.1: Contributions to IT governance theory

Subject	**Classic understanding** (literature)	**Contribution** (chapter)
1) Types of innovation considered	Business strategies can be innovation-oriented (i.e., focus on product and service innovations) (e.g., Sambamurthy and Zmud 1999; Weill and Ross 2004b)	Internal M-Government (i.e., process innovations), external M-Government (i.e., service innovations) (4.1, 4.2, 4.4), as well as SaaS ('delivery model' innovations) (5)
2) Technology contingen-cies	Widely neglected (Brown and Grant 2005, p. 704), except from separation in application and infrastructure governance (e.g., Brown and Magill 1994; Brown 1997; Sambamurthy and Zmud 1999), recently also modularity of technological architecture emphasized (Tiwana and Konsynski 2010)	Information system specificity (especially functional and technical specificity) (5)
3) Level of governance	Widely 'bulk' IT function view, more recently also investment approval (Xue et al. 2008), system development (Tiwana 2009), data (Khatri and Brown 2010), and infrastructure sourcing governance (Xue et al. 2011)	Organization level *and* application level IT governance (5), transformational governance (4.2)
4) Direction of assumed effect[a b]	Strategy→IT governance→Innovation (e.g., Sambamurthy and Zmud 1999; Weill and Ross 2004b)	Strategy→Innovation (4.1), Strategy→IT governance→Innovation (4.2), Strategy→AppGov (5.1), Innovation→AppGov(→IT governance) (5.2), Strategy→Specificity⇆AppGov (5.3), Specificity→AppGov (5.4)
5) Sector focus	Focus on private sector, few research in public sector (Weill and Ross 2004a; Ali and Green 2007; Sethibe et al. 2007)	Public sector (4), private sector (5)
Overall	*Innovation strategies favor decentralized IT governance;* *Efficiency strategies favor centralized IT governance.*	*Process innovations can favor 'transformational governance' and more centralized decision making.* *For external delivery models (SaaS), efficiency strategies can favor higher decentralization of IT governance.*

[a]Strategy = strategic goals of a (government) organization or the competitive strategy of a firm, respectively
[b]AppGov = application governance

Differences between public and private sector organizations are widely discussed in the academic literature. Apparently, the most fundamental difference lies in the primary goal and justification of these two institutional forms for creating public value versus (in a simple view) achieving profit (Moore 1995; Moore and Khagram 2004). Public sector (i.e., non-profit) organizations can be also characterized by lower degree of competition, greater legal and political constraints, fewer performance incentives (both individually and organizationally), greater scrutiny and higher aversion to take risks compared to the private sector (Rocheleau and Wu 2002). Consequently, regarding the role of information systems, it is often argued that public sector organizations view technology more as a necessity rather than a tool for competitive advantage. Risk aversion and the great amount of stakeholders make it more difficult to plan and implement IT-based innovations. Therefore, public organizations are often seen as the late adopters of new technology (Rocheleau and Wu 2002). However, the information intensity of public agencies' task environment and the IT architectural complexity should not be underestimated (Vilvovsky 2008). For example, some of the interviewees in our qualitative studies (Chapters 4.1, 4.2) pointed out that their municipalities managed several hundreds of administrative procedures and according IT applications. Operating such relatively broad spectrum of IT services (e.g., measured by applications per IT staff) would be hardly imaginable for most private companies (since those inherently tend to focus on core their processes). Also, contrary to the stereotype of being 'bureaucracies', authors more recently recognize a move toward more business-like performance measurement and more cost efficiency across all levels of public agencies (Vilvovsky 2008).

Our research suggests that establishing transformational IT governance, i.e. ensuring that responsibilities for IT and organization are effectively aligned, is a valuable practice for public organizations to foster focused IT-based innovation adoption. Based on the outlined characteristics of the public sector, we may explain this by the lack of economic pressure, multiplicity of stakeholders and the lower creativity about technological possibilities. That is, administrative departments of public organizations have a much lower incentive to innovate, especially to implement process innovations that may potentially change their own work practices and jobs.[1] In contrast, business units in private organizations typically have own profit responsibility, so that they are not only inclined to exploit potential IT-based product innovations, but also to constantly improve their own cost base. Accordingly, the call for a 'transformational governance' may seem less relevant for the private sector. However, even many private enterprises resemble large bureaucracies that need to involve a great number of stakeholders in realizing IT-enabled business transformation (Venkatraman 2005). Thus, one may also agrue that in this case the call for aligning IT and organizational responsibilities appears equally important to the public sector. The fact that in recent years an increasing number of large companies have united IT and human resources functions under the same 'roof' of a corporate COO

[1] This aspect became particularly apparent in an anecdote from case D (4.2). The IT department in case D had been given the goal to liberate resources through standardization and automation. Our interviewee told us that when he once tried to explain this to one of the department heads, the department head was literally threatening him by saying "Just try to take one of my staff away".

(Chief Operating Officer) may at least provide weak evidence for this argument (CIO 2008).

The second major finding from this research refers to the *if* and *why* of a governance 'shift' for enterprise SaaS solutions from IT to business units. Based on the differences of public and private sector organizations, we may ask whether the observed shift is also expected for the public sector. First, we have to state that SaaS and Cloud-based service adoption is still limited in public sector due to various challenges related to quality, privacy and security (Janssen and Joha 2011). Our main argument for the decentralization of SaaS authority was based in the transaction cost theoretic consideration of reduced economies of scale for SaaS. Furthermore, we partly attributed this shift to the lower technical specificity of SaaS solutions (i.e., the technological contingencies) and the increased IT skills of business users (i.e., the knowledge-based view). As outlined earlier, IT application landscapes in public sector (at least in municipal governments) exhibit a comparably high technological complexity and low economies of scale. This means that synergies across municipal departments are comparably low since the departments administrate distinct procedures. Therefore, I argue that this is one reason that militates against an occurrence of the propounded shift. Also there is no reason to assume that IT skills of the users in municipal departments are higher than in private sector businesses, so that this is not likely to be a reason either. Rather we assume that the greater legal constraints in the public sector are more likely to allow only for singular adoption of SaaS based solutions under the regime of the IT department, if at all (Janssen and Joha 2011). On the other hand, the fact that administrative procedures do not vary much across different municipal bodies greatly spurs the market opportunities for highly standardized, low cost SaaS-based solutions also in the public sector. Thus, there is still an argument that we will see greater SaaS adoption and an effect on IT governance in the public sector in the future.

6.3 Methodological Contribution: On the Use of Multimethod Research

In this section I review the conducted studies according to the methodologies used. Since this dissertation made use of several research methods, this review particularly intends to identify contributions for the use of multimethod research.

Combining multiple methods and different research paradigms to investigate a specific subject has been generally propounded as a valuable approach, especially in the IS field (Kaplan and Duchon 1988; Orlikowski and Baroudi 1991; Gable 1994; Mingers 2001; 2003). The most advocated approach certainly refers to the combination of qualitative and quantitative research methods, specifically case study and survey research (Kaplan and Duchon 1988; Gable 1994). Later authors proclaim a general pluralism that does not prescribe a mandatory sequence for applying different methods, nor a limitation to a single paradigm (e.g., a strictly positivist view) (e.g., Mingers 2001). Although IS researchers have early accredited the value of multimethod research (Orlikowski and

Baroudi 1991), some meta-reviews still assert a paucity of such pluralist approaches. According to a meta-review, only about 20 percent of the papers in major IS journals apply multiple research methods (Mingers 2003). Barriers to multimethod research have been identified in philosophical (e.g., incompatibilities of different paradigms), cultural (e.g., traditions of different 'schools of thought'), psychological (e.g., personal inclination towards a certain 'style' of research), and practical categories (Mingers 2001). This review particularly intends to explore the practical possibilities on *how to* link different research methods.

An overview of the methodologies used in this dissertation has been presented earlier in Table 3.1 (page 35). The combinations of different research methods can be summarized by four broad categories: a) links from qualitative to quantitative methods, reversely b) links from quantitative to qualitative methods, as well as c) combinations of different qualitative methods, and d) combinations of different quantitative methods, see Table 6.2.

Table 6.2: Multimethod research overview (including chapter numbers)

a) Linking qualitative with quantitative methods • Explorative model generation and model test (5.1→5.2) • Operationalization of a theoretical model and test (4.1) • Procedural regrouping of constructs and test (5.3→5.4)	**b) Linking quantitative with qualitative methods** • Empirical clustering and detailed case analyses (4.1→4.2) • Validating a simulation model in a case study (4.4) • Integration of factors in a process model (5.1/5.2→5.3)
c) Combining qualitative methods • Grounded theory and content analysis (4.2) • Grounded theory and multiple case studies (4.2, 5.1)	**d) Combining quantitative methods**[a] • Factor models and clustering (4.1, 5.2) • Factor models and multidimensional scaling (5.4)

[a]Factor scores from partial least squares structural equation models were used for further analyses

Multimethod research of type **a)** is certainly the most common approach (Kaplan and Duchon 1988; Gable 1994; Mingers 2003). In Chapter 5.1 (Impact of SaaS on IT Governance) we conducted a set of explorative case studies to derive a conceptual model, which was then operationalized and tested in a large-sample survey (Chapter 5.2). This approach, in spite of being allotted to two different research papers, largely matches the multimethod approach propounded by Gable (1994).

Second, qualitative approaches (in this case a content analysis of case interviews) may also be used more simply to operationalize an existing theoretical model, as we demonstrated in Chapter 4.1 (Section 4.1.6). Thus, the role of the qualitative approach in this case is to validate the model previously derived from literature (the E-Government and IS strategy literature) and to transfer it to a survey instrument, rather than inductively generating an 'entirely new' model. This approach is more congruent with Kaplan and Duchon (1988, p. 582), who emphasize the "need for context-specific measures" when investigating a phenomenon of interest. This means practically that adopting questionnaire items from the related literature without such phase of 'qualitative reflection' and applying these in the own research context is less likely to lead to success.

Finally, with Chapters 5.3 and 5.4 we demonstrate that the link between qualitative and quantitative methods can also derive from causal-logical reordering. That is, in Chapter 5.3 we developed the idea that allocation of SaaS governance is the result of a process rather than of a set of contingent factors. This idea led to a regrouping of some of the factors from the prior analysis (Chapter 5.2) as well as an addition of further factors (i.e., human asset and technical specificity) and the explanation of an effect which had previously remained inconclusive (i.e., the effect of specificity on application governance arrangements).

Regarding **b)** the reverse direction from quantitative to qualitative research, in Chapter 4.1 we performed an empirical clustering based on a sample of municipalities and the key model dimensions. These empirical clusters were then used in a subsequent work to analyze one (selected and revelatory) case from each subgroup in detail by the use of qualitative research methods (Chapter 4.2). I argue, that in terms of a proper sampling logic (Yin 2003)—which is often a challenge when seeking for particularly revelatory cases—this type of multimethod approach is very promising and particularly beneficial. This is because, given that these four clusters exhaustively represent the entire population, it strengthens the generalizability of the evidence from the four cases to the whole population (here municipalities in Germany). Practically, this kind of linkage between quantitative and qualitative research can be achieved simply by asking survey respondents for their willingness to serve as a contact person for subsequent case intverviews.

A different approach was taken in Chapter 4.4, where we proposed a quantitative model to estimate the effects of urban sensing adoption. This model was then validated in a case example (the state capital of Saarbrücken) in several steps, including the use of process mapping as well as observing the effects of modeling in a decision making context. Both can be clearly seen as validation methods, i.e. here a quantitative model, in its nature as a human-constructed artifact, is evaluated and proven for 'correctness' by a real-world case study (Hevner et al. 2004; Sein et al. 2011).

A third b)-type of link can be noticed between Chapters 5.1/5.2 and 5.3. In this case, we moved from a contingency theoretic and variance-paradigmatic view to a process-theoretic model of SaaS governance. Such 'switch' of theoretical paradigms is not without challenges, as we outlined in the chapter: "Factors should not be understood as predictors of certain events [...], but rather as a social action that helps to produce the outcome of interest" (Section 5.3.3, page 168). However, the approach taken in that chapter can be regarded as one attempt to link variance with process theories.

As outlined before, the term 'multimethod' also implies that methods can be combined that use the same type of data (i.e., qualitative or quantitative data), but follow potentially different research paradigms. Regarding category **c)**, we have utilized different qualitative methods particularly in two chapters. Chapter 4.2 combines the use of grounded theory with content analysis in a five step approach to *derive* and *valuate* different drivers and inhibitors of M-Government adoption. The strengths of using grounded theory as an analytical method here[2] are that it provides different overarching categories (the coding paradigm, Glaser and Strauss 1967) in function of the relationship to the core phenomenon. Thus, the coding paradigm helps to create a multilevel and relational categorical system (our proposed framework) without the use of prior theory. The key strength of content analysis, opposed to this, is to provide a method for valuating different codes and determining the overall coding reliability. Therefore the combination of the two qualitative approaches appears particularly useful to achieve reliable results, not only in our M-Government context.

The study in Chapter 4.2, as well as a second qualitatively oriented study in Chapter 5.1, also combine grounded theory with a multiple case study approach. In both cases, the categories produced by the grounded theory approach are subsequently instantiated for each case and analyzed in a comparative manner. This, I argue, appears to be a particularly useful approach, since the case study methodology itself hardly provides any advice on *how to analyze* and potentially *cateogrize* the data gathered from a case site (cf. Benbasat et al. 1987; Yin 2003). Benbasat et al. (1987, p. 374) write succinctly that "the analysis of case data depends heavily on the integrative powers of the researcher" and that "a clear chain of evidence should be established." Arguably, the prescriptive approach demanded by the grounded theory method can aid a researcher in improving his/her integrative powers and thus help to discover the relevant chains of evidence. This way of combining the case study method with grounded theory has also been regarded as a beneficial approach by other researchers (e.g., Hughes and Jones 2003; Fernández 2005).

Finally, regarding the combination of different quantitative methods (category **d)**, most of the chapters of this dissertation that apply quantitative survey and path modeling techniques combine these with more descriptive and/or cluster-analytical methods. The motivations for combining these two quantitative approaches (based on the same data) depended on the case. In Chapter 4.1 we presented a descriptive overview of the attractiveness of different mobile services (Table 4.3) primarily to address a practitioner audience (see also Winkler 2011). In the same chapter we also conducted an exploratory cluster analysis based on the factor scores of the main model dimensions (i.e., efficiency goals, innovation goals, IT sophistication) in order to detect potential heterogeneity in the sample (see Figure 4.4). A post-hoc analysis of variance of the factor means suggested the existence of such heterogeneity. In Chapter 5.2 we conducted a similar

[2] Note that grounded theory according to Glaser and Strauss (1967) is a whole research paradigm, rather than only a method to analyze qualitative data. For example, this approach demands no use of prior theory, iterative data collection, theoretical saturation and the use of memoing. However, utilizing grounded theory for analysis is the most common practice in the IS field (Matavire and Brown 2008).

clustering of the factor values of the dependent variables (i.e., decision authority and task responsibility) to detect (and describe) three different patterns of application governance (i.e., IT dominated, business dominated, and mixed patterns).

Finally, in Chapter 5.4, we conducted multidimensional scaling and visualized the similarity characteristics of different application types (e.g., ERP, CRM, SCM, etc.) and the core model dimensions (i.e., functional, human asset and technical specificity, as well as decision authority and task responsibility) in a single two-dimensional plot (Figure 5.9, page 197). This visualization is largely consistent with the results from the model tests, since it is based on the same data. However, it allows us to draw conclusions which are not intuitively attainable from the mere look at the number sheets (see Tables 5.11 and 5.12). The results of factor-based path models have been criticized generally for providing "only partial guidance to the practitioner who must assume responsibility for attaining positive outcomes" (Newman and Robey 1992, p. 250). In this sense, our combination of factor-based path models with more descriptive and/or visualized cluster-analytical methods was mainly motivated by the intention to address a practitioner audience and thus also to increase relevance of this research.

Overall, this compound research makes a case that it is valuable and useful to alternate between different qualitative and quantitative research methods to investigate *the same* phenomenon. The IS literature provides few practical advice on *how to* link different research methods. The presented examples highlight a few possibilities based on the studies conducted in this dissertation. Important to note, I neither state that any of these possibilities are free from limitations, nor that they should be prescribed for other researchers. This ex-post review rather intended to introduce a general framework for multimethod research and provide a few practical insights. In this respect it may contribute a few interesting (and potentially novel) methodological perspectives to the IS field.

6.4 Limitations and Future Research

In this last section I outline the major limitations that should be considered when interpreting the findings of this work and provide directions for future research. The limitations of each single study are reported in the according chapter, so that here I may focus on the outcomes of this compound research.

First, regarding generalizability we have to note that all of the empirical studies were conducted with specific subjects (i.e., municipalities, citizens, and companies, with few exceptions) from Germany. Thus, a transfer of our results to any other national or a global context should consider the potential differences resulting from varying cultural, legal, and economic frameworks. Second, it should be stated again that the path models used in this research (in Chapters 4.1, 4.3, 5.2 and 5.4) only ascertain statistical association, not causal ordering. Causal relationships should derive from the theoretical and empirical arguments made in these and the other, qualitatively oriented chapters.

Furthermore, I add for consideration that the two overall contributions emerging from this compound research, which extend the classical rationale of strategy-structure fit, still require further empirical confirmation. That is, the claim for 'transformational governance' to favor process innovativeness in public sector emerged from the analysis of multiple cases of municipal M-Government adoption. The argument for greater governance decentralization of external delivery models (including SaaS) under an efficiency strategy was derived from the transaction cost theoretic argument of reduced internal economies of scale. I also discussed to what extent these propositions hold for opposed sector contexts (see Chapter 6.2). Nevertheless, both of these propositions still demand an empirical confirmation by a larger sample of public and private sector organizations for adding up to the body of IS knowledge.

Overall, having argued that governance is a dynamic phenomenon (e.g., that the vast SaaS adoption may lead to a governance 'shift' from IT to business units), more research regarding the questions of *how* governance arrangements evolve in firms throughout the IS adoption and assimilation process appears appropriate. Such longitudinal approaches might also help answer the question of the *voluntariness* of IT governance arrangements raised in Chapter 5.2, i.e. to answer to what extent the allocation of responsibility in organizations is the result of formal governance arrangements (as the literature implies), rather than the outcome of (seemingly arbitrary) initiatives of individual actors.

Finally, regarding the cross-sectoral differences in IT governance, I may cite Rocheleau and Wu (2002) who find that "few studies [...] empirically examined differences between public and private information management practices, and the findings have not been very consistent." Thus, assuming that public agencies continue to learn from enterprise practices (and vice versa)[3], the comparative view of sector differences taken here could (and potentially should) be enhanced by more studies that directly assess IT governance practices across public and private sector organizations.

[3]Note that the development of ITIL, a widely used reference framework for IT service management, has been largely driven by a government organization.

Appendices

1 M-Government Survey with German Municipalities (Online)

Forschungsprojekt über kommunale drahtlose Kommunikationsdienste

Herzlich Willkommen zur Umfrage zu ***drahtlosen Kommunikationsdiensten in deutschen Kommunen.***

In deutschen Städten und Gemeinden lässt sich aktuell ein zunehmendes Angebot an innovativen, kommunal betriebenen, drahtlosen Kommunikationsdiensten beobachten. So ist es beispielsweise möglich, Fahrscheine und Parktickets mit einem Mobiltelefon zu bezahlen oder Bücher aus Bibliotheken selbstständig, durch RFID Technologie, zu entleihen. Getrieben wird diese Entwicklung nicht nur durch die vielseitigen technischen Innovationen auf diesem Gebiet, sondern auch durch die steigende Relevanz für die öffentlichen Verwaltungen.

Doch welche dieser mobil nutzbaren Dienste benötigen deutsche Kommunen wirklich um ihre Verwaltungsprozesse effizienter zu gestalten, existierende elektronische Lösungen zu verbessern oder für die Nutzer allgegenwärtig erreichbar zu machen? Was für Angebote gibt es schon? Welche neuartigen Dienste könnten zu Einsparungen, zusätzlichen Einnahmequellen oder wachsender kommunaler Attraktivität beitragen?

Zum jetzigen Zeitpunkt lassen sich diese und viele weitere Fragen nicht genau oder gar nicht beantworten. Diese Wissenslücke möchte diese wissenschaftliche Studie schließen. Sie wird im Rahmen einer Masterarbeit, und weiterer zukünftiger Forschung, am Lehrstuhl Wirtschaftsinformatik der Humboldt-Universität zu Berlin durchgeführt. Die Forschungsschwerpunkte dieser Arbeit sind das Angebot und die Attraktivität mobiler Kommunikationsdienste für deutsche Städte und Gemeinden, die Bedeutung der zugrunde liegenden RFID-, Wireless- und Sensortechnologien und die Hindernisse sowie förderlichen Faktoren einer Realisierung zu untersuchen.

Die Umfrage dauert ca. 40 Minuten und ist wie folgt aufgebaut:

- Allgemeine Informationen zur Stadt und zum Teilnehmer
- Attraktivität und Nutzung von mobilen Diensten
- Treiber, Hemmnisse und Ziele aus kommunaler Sicht
- Abschließende Fragen

Die Ergebnisse der Studie sind für alle Teilnehmer kostenlos nutzbar. So bietet sich für die teilnehmenden Kommunen die Möglichkeit des Vergleichs der eigenen Situation mit der anderer Kommunen. Es können aber auch Erkenntnisse über die Rahmenbedingungen einer erfolgreichen Dienstrealisierung und über besonders aussichtsreiche Anwendungsszenarien gewonnen werden.

Wir bedanken uns im Voraus für Ihre Teilnahme an der Studie und bieten Ihnen an, am Ende des Fragebogens eine E-Mail Adresse zur Übersendung der Studienergebnisse anzugeben.

Datenschutzerklärung:
Alle im Zuge dieser Studie erhobenen Daten werden von uns vertraulich behandelt und nicht an Dritte weitergegeben. Die Analyse und Auswertung der bereitgestellten Daten erfolgt in **anonymisierter** Form. Wir bitten Sie die folgenden Fragen so offen und ehrlich wie möglich zu beantworten um eine Verzerrung der Ergebnisse zu vermeiden. Sollten Sie uns Ihre E-Mail Adresse für ein weiterführendes Interview oder das Übersenden der Studienergebnisse zur Verfügung stellen, wird diese von uns ausschließlich zu diesem Zweck genutzt.

Erläuterung zu Dienst:
Unter einem Dienst wird im Rahmen dieser Studie jede softwarebasierte Anwendung verstanden, die ihren Nutzern bestimmte Informationen oder Funktionalitäten bereitstellt die diese in ihrem Alltag (d.h. beruflich oder privat) unterstützen. Dabei wird mindestens eine der zugrunde liegenden RFID-, Wireless- und Sensortechnologien genutzt. Durch diese drahtlosen Kommunikationstechniken ist es möglich, den jeweiligen Dienst mit einem mobilen Endgerät (z.B. PDA, Netbook, Mobiltelefon) oder mit bestimmten mobilen Komponenten zu nutzen. Diese Bedeutung umfasst auch der in dieser Studie verwendete Begriff **mobiler Dienst**.

Forschungsprojekt über kommunale drahtlose Kommunikationsdienste

Kommunenmerkmale **Seite 1/12**

Als erstes benötigen wir von Ihnen einige Angaben über Ihre Kommune.

Name der Stadt / Kommune:

Name des Bundesland:

bitte wählen

Wie viele Einwohner hat Ihre Kommune?

Wie viele Verwaltungsangestellte hat Ihre Kommune (geschätzt)?

Wie viele interne und externe IT-Mitarbeiter hat Ihre Kommune (geschätzt)?
Dies umfasst alle Mitarbeiter, die in den Bereichen IT-Planung und -verwaltung, Anforderungsmanagement, IT-Entwicklung und -integration, Anwendungs-Management, Rechenzentrum, Webseite, Administration, Netzwerk, Hardware und Büro-Infrastruktur tätig sind.

Anzahl IT-Mitarbeiter in der Planung?
Wie viele IT-Mitarbeiter entfallen auf IT-Planung und Anforderungsmanagement (ungefähre Schätzung)?

Ist in Ihrer Kommune eine IT-Strategie vorhanden?

Nein

Wenn ja, berücksichtigt diese IT-Strategie auch e-Government und m-Government-Bausteine?

Unter **e-Government** wird im Rahmen dieser Studie das Angebot von internetbasierten Diensten zur Unterstützung und Durchführung von Verwaltungsaufgaben verstanden.

M-Government steht im Rahmen dieser Studie für das Angebot von mobil nutzbaren Diensten zur Unterstützung und Durchführung von Verwaltungsaufgaben. Es handelt sich also um eine Erweiterung und/oder Ergänzung des m-Government-Angebots.

Nein

Wie hoch ist der Haushalt Ihrer Kommune (geschätzt, in Mio. Euro)?

Wie hoch ist der IT-Etat Ihrer Kommune (geschätzt, in Mio. Euro)?

Bitte geben Sie an, ob Ihre Position in der Kommune eher der IT oder Verwaltung zuzurechnen ist:
Beispiele IT: IT-Amtsleiter, IT-Fachbereichsleiter, EDV-Leiter, IT-Beauftragter, IT-Referatsleiter, IT- Fachdienstleiter
Beispiele Verwaltung: OB / Bürgermeister, Dezernats-, Fachbereichs-, Behörden-, Amtsleiter, Abteilungsleiter, Referatsleiter

IT

Forschungsprojekt über kommunale drahtlose Kommunikationsdienste

Kommunenmerkmale **Seite 2/12**

Genaue Position in der IT:
Bitte wählen Sie eine Positionsbeschreibung die Ihrer überwiegend ausgeübten Tätigkeit in der kommunalen Organisation am besten entspricht.

- [ ] Höchster kommunaler IT-Entscheider (z.B. IT-Amtsleiter, IT-Fachbereichsleiter, EDV/IT-Leiter)
- [ ] Führungskraft in der kommunalen IT-Verwaltung (z.B. Referatsleiter, Clustermanager)
- [ ] Arbeitskreis/Fachausschussmitglied
- [ ] Abteilungsleiter der kommunalen IT (z.B. Fachdienstleiter)
- [ ] Mitarbeiter der kommunalen IT (z.B. Verwaltungsmitarbeiter IT, Sachbearbeiter IT)
- [ ] Sonstiges (bitte angeben)

Bitte benennen Sie uns die genaue Bezeichnung Ihrer Position:
Die Antwort wird zur genauen Einstufung des Teilnehmers in die Organisationsstruktur benötigt.

Forschungsprojekt über kommunale drahtlose Kommunikationsdienste

Attraktivität kommunaler drahtloser Kommunikationsdienste **Seite 3/12**

Auf den folgenden vier Seiten haben wir eine Auswahl an drahtlosen Kommunikationsdiensten zusammengestellt. Um die Attraktivität dieser existierenden und zukünftigen Diensten aus kommunaler Sicht einschätzen zu können benötigen wir von Ihnen jeweils die folgenden Angaben:

Dienst-Attraktivität (vorgestelltes mobiles Dienstszenario): Wie hoch schätzen Sie die Attraktivität des vorgestellten drahtlosen Kommunikationsdienstes im Hinblick auf die erwartete Nutzung, die Verbesserung der kommunalen Leistungserbringung, die Steigerung der kommunalen Attraktivität und der Lebensqualität ein? Bitte bewerten Sie den Dienst auf einer Skala von 1 (für nicht attraktiv aus Sicht Ihrer Kommune) bis 7 (für sehr attraktiv).

Dienst-Realisierungsgrad: Hier interessieren uns, ob die Kommune aktuell auf dem Gebiet des vorgestellten Anwendungsszenarios Verwaltungsangebote anbietet oder plant.

- ***mobiler Dienst vorhanden***? Bitte wählen Sie diese Box, wenn der jeweils vorgestellte Dienst in Ihrer Kommune in einer mobilen Variante, unter Nutzung von drahtloser Kommunikationstechnologie, angeboten wird.
- ***k-Angebot vorhanden***? Bitte wählen Sie diese Box, wenn in Ihrer Kommune ein *konventionelles Verwaltungsangebot* des vorgestellten Dienstszenarios existiert. Ein konventionelles Verwaltungsangebot umfasst im Rahmen dieser Umfrage alle Verwaltungsangebote, die nicht auf der Nutzung von drahtlosen Kommunikationstechnologien basieren. Zum Beispiel ein papierbasierter oder EDV-gestützter Verwaltungsvorgang für die Durchführung der Verwaltungsaufgabe die dem Dienstszenario zugrunde liegt. Anwendungsbeispiel mobiles Vorschlag-/Meldesystem: die zugrunde liegende Verwaltungsaufgabe ist das Vorschlag-/Meldesystem, ein k-Angebot wäre ein Content Management System mit dem die Verwaltung Verbesserungsvorschläge der Bürger bearbeitet.
- ***mobiler Dienst geplant***? Bitte wählen Sie diese Box, wenn in den nächsten 2 Jahren eine Realisierung des vorgestellten Dienstes, unter Nutzung von drahtloser Kommunikationstechnologie, geplant ist.

Die drahtlosen Kommunikationsdienste sind in die folgenden 9 Anwendungsfelder gegliedert:

- Bürger- und Verwaltungsdienste
- Umwelt
- Sicherheit
- Bildung
- Gesundheit
- Verkehr
- Infrastruktur
- Infrastruktur
- Private Haushalte

Noch eine Bitte: Für die Analyse der Umfrageergebnisse ist es sehr wichtig, dass Sie **die Attraktivität aller Dienste** bewerten.
Nur so können wir zu aussagekräftigen Ergebnissen gelangen, die wir allen teilnehmenden Kommune zur Verfügung stellen werden.
Vielen Dank im Voraus für Ihre Unterstützung.

Bürger- und Verwaltungsdienste	**Dienstattraktivität** (1) nicht attraktiv - sehr attraktiv (7)	**Realisierungsgrad**
Mobiles Vorschlag-/Meldesystem: Verbesserungsvorschläge von Bürgern ortsbezogen mobil aufnehmen und bewerten; kommunale Dienste anfordern; z.B. Bedarf für zusätzliche Ampel, Räumdienstversäumnis, Objekt- oder Infrastrukturreparatur notwendig, Müllentsorgung in Stadt/Umland, Unfallgefahren	1 2 3 4 5 6 7	☐ mobiler Dienst vorhanden ☐ k-Angebot vorhanden ☐ mobiler Dienst geplant
Mobile Wahl: Wahlen und Bürgerentscheide von mobilen Endgeräten aus durchführen; bspw. für Personen mit Mobilitätseinschränkung oder Personen auf Reise	1 2 3 4 5 6 7	☐ mobiler Dienst vorhanden ☐ k-Angebot vorhanden ☐ mobiler Dienst geplant
Mobile Demokratie: Mobile Einflussnahme auf kommunale Projekte, orts- und interessenbezogene Bürgerinformation, Bewertung von Entscheidungsalternativen (z.B. über Umfragen); z.B. Umgehungsstraßenalternativen, Behördenöffnungszeit	1 2 3 4 5 6 7	☐ mobiler Dienst vorhanden ☐ k-Angebot vorhanden ☐ mobiler Dienst geplant
Mobile Verwaltungsarbeit: Mobile Datenerhebung, abteilungsübergreifende medienbruchfreie Verarbeitung, zentrale Speicherung und mobile Nutzung; z.B. Hygieneamt nutzt mobilen Karteizugriff und nimmt Verstoß auf, andere Behörde nutzt diese Daten wiederum mobil	1 2 3 4 5 6 7	☐ mobiler Dienst vorhanden ☐ k-Angebot vorhanden ☐ mobiler Dienst geplant
Stadtinformationsdienst: Ortsbezogener interessenbasierter kommunaler Informationsservice, auch Katastrophenschutz und umweltbedingte Meldungen; z.B. offene Stellen, kurzfristige kommunale Aushilfsarbeitsstellen, Grundstücksverkauf, Erinnerungen	1 2 3 4 5 6 7	☐ mobiler Dienst vorhanden ☐ k-Angebot vorhanden ☐ mobiler Dienst geplant
Mobile Bezahlung kommunaler Gebühren: Verwaltungsgebühren, öffentliche Nutzungsentgelte; zeitabhängige mobile Gebührenbezahlung nach tatsächlichen Nutzungsdauer: Parkplatz-, Schwimmbadnutzung	1 2 3 4 5 6 7	☐ mobiler Dienst vorhanden ☐ k-Angebot vorhanden ☐ mobiler Dienst geplant
Drahtloser Dokumenttransfer: Verwaltungsbescheide oder benötigte Dokumente von/für Verwaltungsprozesse drahtlos übertragen, ermöglicht medienbruchfreie Weiterverarbeitung	1 2 3 4 5 6 7	☐ mobiler Dienst vorhanden ☐ k-Angebot vorhanden ☐ mobiler Dienst geplant
Mobile Bürgerdienste: Dienstleistungsangebot der Verwaltung mittels mobiler Dienste näher zum Bürger bringen (MoBüD), Serviceangebot auch im ländlichen Gebieten	1 2 3 4 5 6 7	☐ mobiler Dienst vorhanden ☐ k-Angebot vorhanden ☐ mobiler Dienst geplant

Forschungsprojekt über kommunale drahtlose Kommunikationsdienste

Attraktivität kommunaler drahtloser Kommunikationsdienste **Seite 4/12**

k-Angebot vorhanden: das Dienstszenario wird in der Kommune als konventioneller Dienst, ohne Nutzung von RFID-, Wireless- oder Sensortechnologie, angeboten.

Umwelt	**Dienstattraktivität** (1) nicht attraktiv - sehr attraktiv (7)	**Realisierungsgrad**
Intelligente Straßenbeleuchtung: Intelligente bedarfsgerechte Steuerung der Straßenbeleuchtung basierend auf drahtlosen Sensoren und Lichtmanagement-Systemen	1 2 3 4 5 6 7	☐ mobiler Dienst vorhanden ☐ k-Angebot vorhanden ☐ mobiler Dienst geplant
Intelligente Gebäudesteuerung: Drahtlose Sensoren steuern und überwachen bedarfsgerecht Innenraumbeleuchtung, Luftzirkulation und -feuchtigkeit, Stromverbraucher	1 2 3 4 5 6 7	☐ mobiler Dienst vorhanden ☐ k-Angebot vorhanden ☐ mobiler Dienst geplant
Intelligente Müllentsorgung: Füllstandsabhängige Entleerung öffentlicher Mülleimer	1 2 3 4 5 6 7	☐ mobiler Dienst vorhanden ☐ k-Angebot vorhanden ☐ mobiler Dienst geplant
Luftverschmutzungsinformationssystem: Sensornetzwerke zur Datenerhebung und Aufbereiten von Luftverschmutzungsdaten, weitere Nutzung z.B. in digitalen Verschmutzungskarten, verschmutzungsabhängige ÖPNV- und Straßenverkehrsteuerung	1 2 3 4 5 6 7	☐ mobiler Dienst vorhanden ☐ k-Angebot vorhanden ☐ mobiler Dienst geplant
Wasserverschmutzungsinformationssystem: Sensornetzwerke zur Datenerhebung und Aufbereiten von Wasserverschmutzungsdaten, weitere Nutzung z.B. in digitalen Verschmutzungskarten, Umweltschutzmaßnahmen	1 2 3 4 5 6 7	☐ mobiler Dienst vorhanden ☐ k-Angebot vorhanden ☐ mobiler Dienst geplant
Lärmbelastungs-Informationssystem: Sensornetzwerke zur Datenerhebung und Aufbereiten von Lärmbelastungsdaten in bestimmten Kernzonen wie Innenstadtbereiche oder Einflugschneisen, weitere Nutzung z.B. in digitalen Verschmutzungskarten, Lärmprävention	1 2 3 4 5 6 7	☐ mobiler Dienst vorhanden ☐ k-Angebot vorhanden ☐ mobiler Dienst geplant
Sicherheit (Öffentliche und Umwelt)		
Ortsbezogener Notrufdienst: Ortsbezogene mobile Meldung von Notfällen z.B. medizinische Notfälle, Naturkatastrophen, Unfälle, Vandalismus/Kriminalität, Verschmutzung	1 2 3 4 5 6 7	☐ mobiler Dienst vorhanden ☐ k-Angebot vorhanden ☐ mobiler Dienst geplant
Öffentliche Videoüberwachung: Kameranetz mit Sensoren und drahtloser Datenübertragung zur Erhöhung der öffentlichen Sicherheit	1 2 3 4 5 6 7	☐ mobiler Dienst vorhanden ☐ k-Angebot vorhanden ☐ mobiler Dienst geplant
Digitale Authentifizierung: Sichere Authentifizierung und Identitätsnachweis durch ePA, RFID-Bürgerkarte oder -Mitarbeiterausweis; Zugangs- und Bewegungskontrolle in Behörden	1 2 3 4 5 6 7	☐ mobiler Dienst vorhanden ☐ k-Angebot vorhanden ☐ mobiler Dienst geplant
Mobiles Feuerwehr-Unterstützungssystem: Mobiler Zugriff auf Informationssysteme zur Unterstützung der Brandbekämpfung; z.B. Zugriff auf Baupläne, Straßenkarten, Ereignis- und Objektinformationen, GPS-gestützte Einsatzkoordination	1 2 3 4 5 6 7	☐ mobiler Dienst vorhanden ☐ k-Angebot vorhanden ☐ mobiler Dienst geplant
Mobiles Polizei-Unterstützungssystem: Mobiler Zugriff auf Informationssysteme zur Unterstützung der Polizeiarbeit; z.B. Zugriff auf Fahrzeugregister, Verbrechensdatenbank, Ereignis- und Objektinformationen, GPS-gestützte Einsatzkoordination	1 2 3 4 5 6 7	☐ mobiler Dienst vorhanden ☐ k-Angebot vorhanden ☐ mobiler Dienst geplant
Personenortung: Unterstützung der Ortung von orientierungslosen / orientierungsschwachen Menschen, z.B. Senioren oder Kindern	1 2 3 4 5 6 7	☐ mobiler Dienst vorhanden ☐ k-Angebot vorhanden ☐ mobiler Dienst geplant
Sicherheitswarndienst: Sicherheitswarnung durch Polizei/Feuerwehr an Mobiltelefone in bestimmter Zone senden z.B. Feuer, Unwetter, Flut, Terrorismus-, Kriminalitäts-, Fahndungsmeldung	1 2 3 4 5 6 7	☐ mobiler Dienst vorhanden ☐ k-Angebot vorhanden ☐ mobiler Dienst geplant

Forschungsprojekt über kommunale drahtlose Kommunikationsdienste

Attraktivität kommunaler drahtloser Kommunikationsdienste **Seite 5/12**

k-Angebot vorhanden: das Dienstszenario wird in der Kommune als konventioneller Dienst, ohne Nutzung von RFID-, Wireless- oder Sensortechnologie, angeboten.

Bildung	**Dienstattraktivität** (1) nicht attraktiv - sehr attraktiv (7)	**Realisierungsgrad**
Bildungsinformationssystem: Eltern mobil über Leistungen, Fehlzeiten der Kinder und Besonderheiten des Schulbetriebs informieren, Eltern-Lehrer Dialog fördern; Schüler/Studierende über Ausfälle und Veränderungen im Lehrbetrieb informieren	1 2 3 4 5 6 7	☐ mobiler Dienst vorhanden ☐ k-Angebot vorhanden ☐ mobiler Dienst geplant
Elektronische Schüler- und Studierendenkarte: Effizientere Hochschulverwaltung durch den Einsatz von RFID-Karte z.B. für Mittagessen, Bibliotheksverwaltung, Authentifizierung, Semester-/Schülerticket, Gebührenabrechnung	1 2 3 4 5 6 7	☐ mobiler Dienst vorhanden ☐ k-Angebot vorhanden ☐ mobiler Dienst geplant
Elektronische Bibliothekskarte: Optimieren der Bibliotheksverwaltung und Sicherheit durch den Einsatz von RFID-Nutzerkarten und Buchidentifikation	1 2 3 4 5 6 7	☐ mobiler Dienst vorhanden ☐ k-Angebot vorhanden ☐ mobiler Dienst geplant
Mobile Bibliothek: Mobile Medienrecherche, Vormerkung, Bestellung, Medienverlängerung und Ausleihe digitaler Medien; drahtlose Übertragung digitaler Dokumente zum mobilen Lesen/Hören auch für blinde und sehbehinderte Menschen	1 2 3 4 5 6 7	☐ mobiler Dienst vorhanden ☐ k-Angebot vorhanden ☐ mobiler Dienst geplant
m-Kindergarten: Informationsdienst für Eltern über alle Belange bezüglich des Kindergartens auf mobilen Endgeräten z.B. Erinnerung an Zahlungen/Verwaltung, Informationen rund ums Kind	1 2 3 4 5 6 7	☐ mobiler Dienst vorhanden ☐ k-Angebot vorhanden ☐ mobiler Dienst geplant
Gesundheit		
Medizinerinformationsdienst: Mobil genutzter Informationsdienst zur Unterstützung von medizinischem Personal; z.B. mobiler Zugriff auf Krankenakte, Analyseergebnisse, Versicherungsdetails, aktuelle Medikamentendaten, Datenübermittlung für zweite Meinung	1 2 3 4 5 6 7	☐ mobiler Dienst vorhanden ☐ k-Angebot vorhanden ☐ mobiler Dienst geplant
Patienteninformationsdienst: Mobiler Informationsdienst für Patienten, z.B. Analyse-/ Diagnoseergebnisse, neue wirkungsvollere/günstigere Medikamente, Arztbesuchsterminerinnerung, Medikamenteinnahmeerinnerung, Pollenflugwarnung	1 2 3 4 5 6 7	☐ mobiler Dienst vorhanden ☐ k-Angebot vorhanden ☐ mobiler Dienst geplant
Angehörigeninformationsdienst: Mobiler Informationsdienst für Angehörige von Patienten/Pflegebedürftigen z.B. Einwilligungen erforderlich, Zustandsänderung	1 2 3 4 5 6 7	☐ mobiler Dienst vorhanden ☐ k-Angebot vorhanden ☐ mobiler Dienst geplant
Mobile Pflegedienstverwaltung: Mobile Koordination der Pflegedienstmitarbeiter, Information der Pflegebedürftigen über zeitliche Verschiebung, tatsächliche Ankunft	1 2 3 4 5 6 7	☐ mobiler Dienst vorhanden ☐ k-Angebot vorhanden ☐ mobiler Dienst geplant
Mobile Telemedizindienste: Sensorbasierte Lebensfunktionsüberwachung im häuslichen Bereich mit drahtlosem Datenaustausch, digitaler Hilferuf und Notfallmaßnahmeneinleitung bei bestimmten Patientengruppen	1 2 3 4 5 6 7	☐ mobiler Dienst vorhanden ☐ k-Angebot vorhanden ☐ mobiler Dienst geplant
Barrierefreie Navigation: Ortsbezogenes mobiles Assistenzsystem für Menschen mit körperlichen Einschränkungen wie Mobilitäts- oder Sehbehinderungen; z.B. Straßen-, Unterführungs-, Ampelwarn- und Leitsystem über digitale Stimme; Stadtnavigation für mobilitätseingeschränkte Menschen	1 2 3 4 5 6 7	☐ mobiler Dienst vorhanden ☐ k-Angebot vorhanden ☐ mobiler Dienst geplant
Gesundheitsdokumenttransfer: Drahtloser Dokumententransfer auf mobiles Endgerät; z.B. Patientenakte, Diagnosen, Infobroschüren, Medikamentenliste, Medikationsinformation und elektronische Erinnerung	1 2 3 4 5 6 7	☐ mobiler Dienst vorhanden ☐ k-Angebot vorhanden ☐ mobiler Dienst geplant
Spenderinformationsdienst: Mobile Information zu Blut-, Knochenmarkspendebedarf für spendebereite Menschen im Bedarfsgebiet	1 2 3 4 5 6 7	☐ mobiler Dienst vorhanden ☐ k-Angebot vorhanden ☐ mobiler Dienst geplant

Forschungsprojekt über kommunale drahtlose Kommunikationsdienste

Attraktivität kommunaler drahtloser Kommunikationsdienste **Seite 6/12**

k-Angebot vorhanden: das Dienstszenario wird in der Kommune als konventioneller Dienst, ohne Nutzung von RFID-, Wireless- oder Sensortechnologie, angeboten.

Verkehr	**Dienstattraktivität** (1) nicht attraktiv - sehr attraktiv (7)	**Realisierungsgrad**
Sensorgestützte Fahrgastinformation: Information von Passagieren des öffentlichen Verkehrs; gestützt durch Sensordaten zu Passagieraufkommen an Haltestellen, Transportmittelauslastung und Betriebsablauf; z.B. realistische Ankunftszeiten, optimale Einstiegstür bei hoher Auslastung, alternative Transportmittel- / Routenempfehlungen; Information der Reisenden auf mobile Endgeräte	1 2 3 4 5 6 7	☐ mobiler Dienst vorhanden ☐ k-Angebot vorhanden ☐ mobiler Dienst geplant
Intelligentes Verkehrs- und Transportkoordinationssystem: Sensorgestütztes drahtloses Verkehrsmanagementsystem mit Berücksichtigung von Transportaufkommen, Stau, Luftverschmutzung, Unfallrisiken und Verkehrswegeauslastung; umfasst Stauwarnung, Ampelsteuerung, Routenplanung, luftverschmutzungsabhängige Innenstadtbefahrung, dynamische Innenstadtmaut und ÖPNV-Kapazitätssteuerung	1 2 3 4 5 6 7	☐ mobiler Dienst vorhanden ☐ k-Angebot vorhanden ☐ mobiler Dienst geplant
Intelligente Verkehrswegeplanung und Wartung: Sensordatenbasierte Verkehrswegeausbauplanung in Abhängigkeit von z.B. Auslastung, Luftverschmutzung/ Lärmbelastung; Wartungsplanung abhängig von Zustand, Belastung, Witterung	1 2 3 4 5 6 7	☐ mobiler Dienst vorhanden ☐ k-Angebot vorhanden ☐ mobiler Dienst geplant
Dynamische Routenplanung für Transportdienste: Bedarfsgerechte Schüler-, Senioren-, und Krankentransporte durch ortsbezogene mobile Dienstanforderung und Transportkoordination	1 2 3 4 5 6 7	☐ mobiler Dienst vorhanden ☐ k-Angebot vorhanden ☐ mobiler Dienst geplant
Mobile Bezahlung von ÖPVN-Tickets: bargeldlose Bezahlung mit mobilem Endgerät	1 2 3 4 5 6 7	☐ mobiler Dienst vorhanden ☐ k-Angebot vorhanden ☐ mobiler Dienst geplant
Automatische Maut-/Nutzungsgebührenabrechnung: Automatisierte Abrechnung der gefahrenen Kilometer auf Mautstrecken oder gebührenpflichtigen Strecken (Innenstädte, Brücken)	1 2 3 4 5 6 7	☐ mobiler Dienst vorhanden ☐ k-Angebot vorhanden ☐ mobiler Dienst geplant
Parkleitdienst: Steuerung der Parkraumauslastung über drahtloses Parkleitsystem, standortabhängige Information und mobile Reservierung von Parkplätzen, Parkplatznavigation	1 2 3 4 5 6 7	☐ mobiler Dienst vorhanden ☐ k-Angebot vorhanden ☐ mobiler Dienst geplant
Carsharing: Mobile Ortung, Reservierung, Kontakt und Verwaltung von Carsharing-Pools	1 2 3 4 5 6 7	☐ mobiler Dienst vorhanden ☐ k-Angebot vorhanden ☐ mobiler Dienst geplant
Mitfahrangebotsbörse: Mobile ortsbezogene Mitfahrangebotsbörse für Pendler, Fahrten zur Arbeit/Einkauf	1 2 3 4 5 6 7	☐ mobiler Dienst vorhanden ☐ k-Angebot vorhanden ☐ mobiler Dienst geplant
Infrastruktur		
Intelligente Objektverwaltung: Identifikation, Ortung, Wartungszyklussteuerung und Ausfall-/Überlastverwaltung von öffentlichen Anlagen/Objekten; z.B. Rolltreppen, Ampeln	1 2 3 4 5 6 7	☐ mobiler Dienst vorhanden ☐ k-Angebot vorhanden ☐ mobiler Dienst geplant
Sensorgestützter Netzbetrieb: Von Wasser-, Gas- und Stromnetzen; z.B. Leckerkennung, Lastspitzenprognose, Flusskontrolle, Lastabhängige Nutzungspreise, Netzmonitoring	1 2 3 4 5 6 7	☐ mobiler Dienst vorhanden ☐ k-Angebot vorhanden ☐ mobiler Dienst geplant
Tourismus und Kultur		
Mobiler Touristenführer/Stadtinformation: Ortsbasierte und nutzerinteressen-abhängige Information, visuell optimierte Stadtnavigation, dynamische Angebote und Touren z.B. Eventtour, Museumstour, Wanderroute	1 2 3 4 5 6 7	☐ mobiler Dienst vorhanden ☐ k-Angebot vorhanden ☐ mobiler Dienst geplant
Mobiles Stadtgedächtnis: Städtegedächtnis/Archive von Bürgern gepflegt, drahtlose ortsbasierte und nutzerinteressenabhängige Informationen/Touren, Umkreiserkundung	1 2 3 4 5 6 7	☐ mobiler Dienst vorhanden ☐ k-Angebot vorhanden ☐ mobiler Dienst geplant

Forschungsprojekt über kommunale drahtlose Kommunikationsdienste

Attraktivität kommunaler drahtloser Kommunikationsdienste **Seite 7/12**

k-Angebot vorhanden: das Dienstszenario wird in der Kommune als konventioneller Dienst, ohne Nutzung von RFID-, Wireless- oder Sensortechnologie, angeboten.

Weiter Tourismus und Kultur	**Dienstattraktivität** (1) nicht attraktiv - sehr attraktiv (7)	**Realisierungsgrad**
Museumsführer: Drahtloser positionsbezogener Museumsführer für Mobiltelefon der Besucher oder separates Endgerät	1 2 3 4 5 6 7	☐ mobiler Dienst vorhanden ☐ k-Angebot vorhanden ☐ mobiler Dienst geplant
Besichtigungsempfehlungssystem: Ortsbasiertes Empfehlungssystem für sehenswerte Orte/Objekte basierend auf den Bewertungen anderer Nutzer und einem Interessenprofil	1 2 3 4 5 6 7	☐ mobiler Dienst vorhanden ☐ k-Angebot vorhanden ☐ mobiler Dienst geplant
Mobiles Fernsehen: digitales Fernsehen über mobile Endgeräte	1 2 3 4 5 6 7	☐ mobiler Dienst vorhanden ☐ k-Angebot vorhanden ☐ mobiler Dienst geplant
2D-Code Informationsdienst: Informationen über Objekt oder Sehenswürdigkeiten abrufbar über auslesen eines lokal angebrachten 2D-Codes (zweidimensionaler "Strichcode")	1 2 3 4 5 6 7	☐ mobiler Dienst vorhanden ☐ k-Angebot vorhanden ☐ mobiler Dienst geplant
Informationskioske: Computergestützte Informationspunkte an öffentlich zugänglichen Stellen mit Internetanbindung und WLAN-Angebot	1 2 3 4 5 6 7	☐ mobiler Dienst vorhanden ☐ k-Angebot vorhanden ☐ mobiler Dienst geplant
Mobiles Ticketbuchungssystem: Ortsunabhängige Buchung von Tickets für Veranstaltungen aller Art z.B. Museum	1 2 3 4 5 6 7	☐ mobiler Dienst vorhanden ☐ k-Angebot vorhanden ☐ mobiler Dienst geplant
Private Haushalte		
Vernetzte Wohnwelt: Sensorgestützte Steuerung und Überwachung von Haushaltsobjekten, intelligente umwelteffiziente Gerätesteuerung z.B. Waschmaschine wäscht mit Nachtstrom, Heizung erkennt offene Fenster, Licht schaltet bedarfsgerecht, Kühlschrank meldet aufgebrauchte/verfallende Produkte	1 2 3 4 5 6 7	☐ mobiler Dienst vorhanden ☐ k-Angebot vorhanden ☐ mobiler Dienst geplant
Gemeinschaftseinkauf: Nutzung von Synergien wie Rabatte, Zeit- und Transportkostenersparnis durch gebündelte Einkäufe mehrere Haushalte	1 2 3 4 5 6 7	☐ mobiler Dienst vorhanden ☐ k-Angebot vorhanden ☐ mobiler Dienst geplant
Haustierortung: Haustiere haben GPS/Sensor-Chip im Halsband, Ortung entlaufener Tiere, Ortung von Stadtverschmutzung durch Haustier-Exkremente und Ermittlung des Tierhalters	1 2 3 4 5 6 7	☐ mobiler Dienst vorhanden ☐ k-Angebot vorhanden ☐ mobiler Dienst geplant
Drahtloser Breitband-Internetzugang: Drahtloser Internet- und Dienstezugang als kommunale Infrastruktur für Bürger und Unternehmen; freier Internetzugang für bildungsferne Schichten, finanzschwache Haushalte und Verwaltungsangestellte unterwegs; mobiles Arbeiten außerhalb des Büros	1 2 3 4 5 6 7	☐ mobiler Dienst vorhanden ☐ k-Angebot vorhanden ☐ mobiler Dienst geplant
Mobile Nachbarschaftshilfe: Bedarf an sozialem Engagement ortsbezogen mobil ermitteln und an hilfsbereite Mitbürger in bestimmten Umkreis senden; Ausbau der sozialen Gemeinschaft; Beispiele: Autostarthilfe, Werkzeug borgen, Haustierfütterung, Ehrenamt	1 2 3 4 5 6 7	☐ mobiler Dienst vorhanden ☐ k-Angebot vorhanden ☐ mobiler Dienst geplant
Mobile Seniorendienste: Mobiles ortsbezogenes Anfordern von Begleit- und Fahrdiensten, Hauswirtschaftshilfe, Wäschedienst, Einkäufen; mobile Koordination der Dienstleister	1 2 3 4 5 6 7	☐ mobiler Dienst vorhanden ☐ k-Angebot vorhanden ☐ mobiler Dienst geplant
Mobile Soziale Netzwerke: Mobiles Endgerät informiert über bestimmte Person des sozialen Netzwerks im Umkreis des eigenen Standortes	1 2 3 4 5 6 7	☐ mobiler Dienst vorhanden ☐ k-Angebot vorhanden ☐ mobiler Dienst geplant

Weitere Dienste:
Gibt es weitere drahtlose Kommunikationsdienste die aus der Sicht Ihrer Kommune von Interesse sind oder sein werden? Dann geben Sie uns diese bitte hier an:

Forschungsprojekt über kommunale drahtlose Kommunikationsdienste

Potenzialeinschätzung für Anwendungsbereiche **Seite 8/12**

Wie hoch würden Sie zusammenfassend das Nutzenpotenzial drahtloser Kommunikationsdienste in den gerade vorgestellten neun Anwendungsbereichen einschätzen?

Auch hier noch einmal die Bitte: Für die Analyse der Umfrageergebnisse ist es sehr wichtig, dass Sie auch auf den nächsten drei Seiten alle Fragen beantworten. Vielen Dank im Voraus für Ihre Unterstützung.

Anwendungsbereiche drahtloser Kommunikationsdienste	**Nutzenpotenzial** (1) kein Nutzenspotenzial - sehr großes Nutzenpotenzial (7)						
Bürger- und Verwaltung	1 ○	2 ○	3 ○	4 ○	5 ○	6 ○	7 ○
Umwelt	1 ○	2 ○	3 ○	4 ○	5 ○	6 ○	7 ○
Sicherheit	1 ○	2 ○	3 ○	4 ○	5 ○	6 ○	7 ○
Bildung	1 ○	2 ○	3 ○	4 ○	5 ○	6 ○	7 ○
Gesundheit	1 ○	2 ○	3 ○	4 ○	5 ○	6 ○	7 ○
Verkehr	1 ○	2 ○	3 ○	4 ○	5 ○	6 ○	7 ○
Infrastruktur	1 ○	2 ○	3 ○	4 ○	5 ○	6 ○	7 ○
Tourismus und Kultur	1 ○	2 ○	3 ○	4 ○	5 ○	6 ○	7 ○
Private Haushalte	1 ○	2 ○	3 ○	4 ○	5 ○	6 ○	7 ○

Forschungsprojekt über kommunale drahtlose Kommunikationsdienste

Motivationsfaktoren für die Diensteinführung (Treiber) **Seite 9/12**

Wie hoch schätzen Sie den fördernden (treibenden/motivierenden) Einfluss folgender Faktoren ein, um drahtlose Kommunikationsdienste in ihrer Kommune zu realisieren?

Potenzielle Treiber/Motivationsfaktoren für kommunal angebotene Dienste	**Fördernder Einfluss des Faktors auf die Realisierung von drahtlosen Kommunikationsdiensten** (1) kein Einfluss - sehr hoher Einfluss (7)						
Allgemeines Nutzenpotenzial: Nutzen für Anwender und Kommune vorhanden, Schaffen einer Win-Win-Situation	1	2	3	4	5	6	7
Bedarf: Bei Wirtschaft, Bürger und Verwaltung für drahtlose Kommunikationsdienste zur Verbesserung der Verwaltungsarbeit	1	2	3	4	5	6	7
Finanzielle Anreize: Zwang zum Sparen durch Effizienz/Effektivitätserhöhung, Verfügbarkeit von Fördermitteln	1	2	3	4	5	6	7
Wirtschaftsförderung: Stärkung der kommunalen Wirtschaft durch Innovation und Technologieentwicklung	1	2	3	4	5	6	7
Externer Erwartungsdruck: von Bürgern und Wirtschaft zur Verbesserung der Verwaltung und Angebot innovativer mobiler Dienste	1	2	3	4	5	6	7
Demografischer Wandel: zunehmende Bevölkerungsalterung und Technikaffinität	1	2	3	4	5	6	7
Schaffen neuer nutzenstiftender Verwaltungsdienstangebote: ermöglicht durch mobile Technologien	1	2	3	4	5	6	7
Themenspezifische Netzwerk nutzbar: Netzwerke vorhanden mit Möglichkeit des Erfahrungs- und Best-Practice-Austausch, Unterstützung bei Planung, Umsetzung, Fördermittelakquise und Wirtschaftskontakten	1	2	3	4	5	6	7
Synergien bei Standarddiensten: Entwicklung und Angebot mit anderen Kommunen bündeln z.B. in Dienstleistungszentren	1	2	3	4	5	6	7
Kosten und Risikominimierung: durch Nutzung vorhandener Infrastrukturen und standardisierter Technologien	1	2	3	4	5	6	7
Projektpartnerschaft: bei der Infrastruktur- und/oder Dienstrealisierung (z.B. Public-Public, Public-Privat)	1	2	3	4	5	6	7
Projektpartnerschaft: bei der Projektentwicklung (z.B. Hochschule, Forschungsinstitute)	1	2	3	4	5	6	7
Konstanter politischer Wille: für die Realisierung des Dienstes über die gesamte Projektlaufzeit	1	2	3	4	5	6	7
Effektives Entscheidungsgremium: Fachspezifische Zusammensetzung, geringe Fluktuation, untereinander bekannte Teilnehmer	1	2	3	4	5	6	7
Dienstleistungsstrategie vorhanden: In der Kommune existiert eine behördenübergreifende Planung zukünftiger Dienstleistungsangebote die auch die Nutzung moderner IT-Technologien und Kommunikationswege berücksichtigt	1	2	3	4	5	6	7
IT-Strategie vorhanden: In der Kommune existiert eine behördenübergreifende IT-Strategie mit e-Government und m-Government Bestandteilen	1	2	3	4	5	6	7
Elektronischer Verwaltungsprozess: Der Verwaltungsprozess, der dem neuen mobilen Dienst zugrunde liegt, ist bereits elektronisch abgebildet (z.B. mit CMS)	1	2	3	4	5	6	7

Weitere Treiber:
Gibt es weitere fördernde/treibenden/motivierenden Einflussfaktoren für die Realisierung drahtloser Kommunikationsdienste, die aus der Sicht Ihrer Kommune von Interesse sind? Dann geben Sie uns diese bitte hier an (je Zeile ein Treiber): :

Forschungsprojekt über kommunale drahtlose Kommunikationsdienste

Übergeordnete Ziele

Seite 11/12

Wie wichtig waren/sind die folgenden übergeordneten Ziele für eine Diensteinführung in Ihrer Kommune? Berücksichtigen Sie bitte auch im Aufbau befindliche oder gegebenenfalls zukünftige drahtloser Kommunikationsdienste.

Ziele für kommunal angebotene Dienste:	**Wichtigkeit der Ziele** (1) völlig unwichtig - sehr wichtig (7)						
Effizienzsteigerung: verwaltungsintern, abteilungs- und kommunenübergreifend, Einsparungen realisierend	1 ○	2 ○	3 ○	4 ○	5 ○	6 ○	7 ○
Attraktivitätssteigerung: für Bürger, Unternehmen und Besucher; z.B. durch Vorreiter im Dienstangebot, Dienstqualität	1 ○	2 ○	3 ○	4 ○	5 ○	6 ○	7 ○
Politische Partizipation steigern: durch transparentere politische Prozesse, bessere Information und Einbeziehung	1 ○	2 ○	3 ○	4 ○	5 ○	6 ○	7 ○
Verbesserung der sozialen Situation: Gemeinschaftsgefühl, Sicherheit, Bildung, Zukunftschancen; Bedarfsgerechte Angebote für soziale Gruppen wie Zuwanderer	1 ○	2 ○	3 ○	4 ○	5 ○	6 ○	7 ○
Ökologie, Klima- und Umweltschutz: z.B. über optimiertes Ressourcen-/ Verkehrsmanagement	1 ○	2 ○	3 ○	4 ○	5 ○	6 ○	7 ○
Wirtschaftsförderung: Sicherung und Schaffung von Arbeitsplätzen, Förderung der lokalen Wirtschaft	1 ○	2 ○	3 ○	4 ○	5 ○	6 ○	7 ○

Investitionsvolumen
Bitte schätzen Sie das Investitionsvolumen Ihrer Kommune für drahtlose Kommunikationsdienste der nächsten drei Jahre (Angabe in tausend Euro):

- ○ 0 - 50
- ○ 51 - 100
- ○ 101 - 250
- ○ 251 - 500
- ○ 501 - 1.000
- ○ 1.001 - 5.000
- ○ 5.001 - 10.000
- ○ > 10.000
- ○ keine Angabe

Forschungsprojekt über kommunale drahtlose Kommunikationsdienste

Demographie und Umfrageergebnisse **Seite 12/12**

Bitte geben Sie uns nachfolgend noch einige Informationen zu Ihrer Person für die Teilnehmerstatistik an.

Geschlecht:
Bitte wählen Sie:
- weiblich
- männlich

Alter:
Bitte wählen Sie:
- 20 - 29
- 30 - 39
- 40 - 49
- 50 - 59
- 60 - 69
- > 70
- keine Angabe

Technologieinteresse:
Welche Aussage trifft am ehesten beim Kauf eines neuen technischen Produktes auf Sie zu (z.B. neue Mobiltelefongeneration):
- Ich gehöre zu den ersten 5 bis 10 % der Käufer eines innovativen Produkts, auch wenn diese extrem teuer und noch unausgereift ist
- Ich bin ein früher Käufer (folgende 10-15%), auch wenn das Produkt noch recht teuer und wenig ausgereift ist
- Ich gehöre zu der frühen Mehrheit der Käufer (folgende 30%), wenn die Preise moderat und das Produkt ausgereift ist
- Ich gehöre zur späten Mehrheit der Käufer (weitere 30%), wenn die Preise niedrig und das Produkt ein Standart geworden ist
- Ich gehöre zu den Nachzüglern beim Kauf (letzte 20% der Käufer), wenn die Preise sehr niedrig sind und das Produkt fast jeder hat

Informationsgrad:
Wie gut fühlen Sie sich bezüglich der angesprochenen Technologien und Dienste informiert?
1 = Ich fühle mich gar nicht informiert, kannte keine der angesprochenen Dienste und Technologien
7 = Ich fühle mich sehr gut informiert, kannte alle angesprochenen Dienste und Technologien
Bitte wählen Sie:

1 2 3 4 5 6 7

Studienergebnisse:
Sind Sie an den Ergebnissen der Studie interessiert?

Ja

Falls ja, geben Sie uns bitte hier Ihre Email-Adresse an:
Diese Email-Adresse wird von uns ausschließlich zum Übersenden der Studie verwendet.

Weitere Teilnahme:
Würden Sie für eine weiterführende Studie im Rahmen eines Telefoninterviews zur Verfügung stehen?

Ja

Sollten Sie Interesse haben, bitte geben Sie hier Ihre Kontaktdaten an:

Name:

Position:

Telefon:

E-Mail:

Können Sie uns einen weiteren Ansprechpartner in Ihrer Kommune empfehlen, mit dem wir zu diesem Zweck sprechen sollten?

Name:

Position:

Telefon:

E-Mail:

Kommentar:
Haben Sie Anregungen oder Fragen für uns, dann teilen Sie die bitte an dieser Stelle mit:

2 Citizen Acceptance Survey (Online)

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Humboldt-Universität zu Berlin

Survey - User Acceptance for a Mobile Reporting Service

[22%]

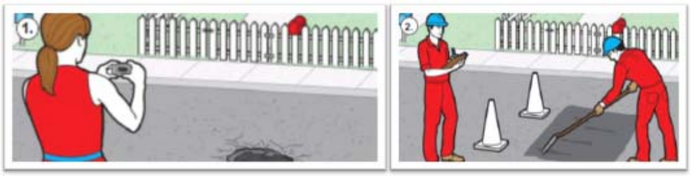
Willkommen zu unserer Studie der Nutzerakzeptanz für einen mobilen Meldedienst!

Diese Studie findet im Rahmen eines Forschungsprojektes an der Humboldt-Universität zu Berlin statt. Ziel der Studie ist, die Nutzerakzeptanz für einen (fiktiven) mobilen Meldedienst in der städtischen Instandhaltung zu untersuchen.

Ein mobiler Meldedienst kann Sie dabei unterstützen, städtische Infrastrukturprobleme (z.B. Schlaglöcher, Müll, Graffitis) mit Hilfe eines internetfähigen Mobiltelefons an die kommunale Verwaltung zu berichten. Hierfür machen Sie mit dem Mobiltelefon ein Foto von dem Problem und geben eine kurze Beschreibung dazu ein. Anschließend erhält die kommunale Verwaltung Ihre Meldung und kümmert sich um die Problembeseitigung.

Infrastrukturprobleme:

Mobiler Meldedienst:



Das Angebot derartiger Dienste wird zunehmend attraktiver für städtische Verwaltungen. Ihre Teilnahme würde uns dabei helfen, die Faktoren der Nutzerakzeptanz genauer zu ermitteln.

Das Ausfüllen des Fragebogens dauert ca. 10 Minuten. Alle Informationen werden selbstverständlich vertraulich behandelt. Auf der letzten Seite können Sie Ihre Email-Adresse angeben, wenn Sie an den Ergebnissen der Studie interessiert sind.

Vielen Dank für Ihre Teilnahme,
Guillaume Trouvilliez, Henry Hirsch & Till Winkler.

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Survey - User Acceptance for a Mobile Reporting Service

[33%]

1. Mobiltelefon-Nutzung

Wie oft nutzen Sie ein Mobiltelefon?

Mehrmals täglich	Mehrmals pro Woche	Mehrmals im Monat	seltener	Ich nutze kein Mobiltelefon
○	○	○	○	○

Unterstützt Ihr Mobiltelefon die Nutzung von mobilem Internet (2G/3G, kein WLAN)?

ja	nein
○	○

Planen Sie die Nutzung eines internetfähigen Mobiltelefons (Smartphone) in der Zukunft?

Ich nutze bereits ein Smartphone	Ich habe fest vor, ein Smartphone zu nutzen	Vielleicht werde ich ein Smartphone nutzen	Ich werde wahrscheinlich keins nutzen	Nein, das habe ich nicht vor
○	○	○	○	○

Unterstützt Ihr Mobiltelefon die Installation von Anwendungen eines App-Store, wenn ja von welchem?

- Bitte wählen Sie -

Hinweis: Bitte setzen Sie den Fragebogen unabhängig von der Beantwortung dieser Fragen fort. Die Nutzung eines Smartphones ist keine Voraussetzung für die Beantwortung der folgenden Fragen.

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[44%]

2. Persönliche Motivationen

Inwieweit stimmen Sie den folgenden Aussagen bezüglich Ihrer Umgebung zu:

	Stimme nicht zu	Stimme eher nicht zu	Weder noch	Stimme eher zu	Stimme zu
Ich sorge mich um Infrastrukturbelange in meiner Umgebung.	○	○	○	○	○
Ich möchte, dass Infrastrukturprobleme in meiner Umgebung behoben werden.	○	○	○	○	○
Ich bin daran interessiert, meine Umgebung in Ordnung zu halten.	○	○	○	○	○
Ich begrüße es, wenn die Anlagen meiner Stadt sauber und ordentlich sind.	○	○	○	○	○
Infrastrukturbelange in meiner Umgebung sind mir egal.	○	○	○	○	○

Inwieweit stimmen Sie den folgenden Aussagen bezüglich Ihrer lokalen Mitwirkung zu:

	Stimme nicht zu	Stimme eher nicht zu	Weder noch	Stimme eher zu	Stimme zu
Ich möchte in meiner Stadt mitbestimmen.	○	○	○	○	○
Ich möchte die Aufmerksamkeit meiner Stadt auf bestimmte Missstände lenken.	○	○	○	○	○
Ich möchte an Entscheidungen in meiner Stadt teilhaben.	○	○	○	○	○
Ich teile der Kommune Belange mit, die ich für wichtig erachte.	○	○	○	○	○
Ich brauche keinen Einfluss in meiner Stadt.	○	○	○	○	○

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Survey - User Acceptance for a Mobile Reporting Service [56%]

3. Mobile Dienste

Definition: Im Rahmen dieses Fragebogens verstehen wir unter *mobilen Diensten* jegliche Internetdienste, die von einem Mobiltelefon aus genutzt werden können, z.B. Email, Suchmaschinen oder Online-Stadtpläne.

Inwieweit stimmen Sie den folgenden Aussagen bezüglich Ihrer Kenntnis im Umgang mit mobilen Diensten zu:

	Stimme nicht zu	Stimme eher nicht zu	Weder noch	Stimme eher zu	Stimme zu
Mir fällt es leicht, Internetdienste auf einem Mobiltelefon zu nutzen.	○	○	○	○	○
Ich kenne mich gut mit der Nutzung von mobilen Diensten aus.	○	○	○	○	○
Ich nutze oft Internetdienste auf einem Mobiltelefon.	○	○	○	○	○
Ich benötige Hilfe bei der Benutzung von Diensten auf dem Mobiltelefon.	○	○	○	○	○

Inwieweit stimmen Sie folgenden Aussagen bezüglich Ihres Vertrauens in mobile Dienste zu:

	Stimme nicht zu	Stimme eher nicht zu	Weder noch	Stimme eher zu	Stimme zu
Ich denke, dass Anbieter mobiler Dienste Nutzerdaten missbrauchen können.	○	○	○	○	○
Ich stelle mobilen Diensten ungern persönliche Informationen bereit.	○	○	○	○	○
Ein mobiler Dienst kann meine persönlichen Daten preisgeben.	○	○	○	○	○
Ich glaube, dass man Anbietern von mobilen Diensten vertrauen kann.	○	○	○	○	○

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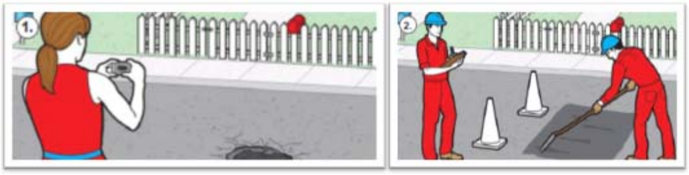
Survey - User Acceptance for a Mobile Reporting Service [67%]

4. Nutzung eines mobilen Meldedienstes

Nun stellen Sie sich vor, dass Sie einen Meldedienst auf Ihrem internetfähigen Mobiltelefon nutzen können. Die Anwendung erlaubt Ihnen, einen Eintrag für ein neues Infrastrukturproblem zu erstellen. Anschließend können Sie ein Foto von dem Problem machen, eine kurze Beschreibung eingeben, sowie die genaue Position des Problems bestimmen. Am Ende bestätigen Sie und die Meldung wird an die kommunale Verwaltung gesendet.



Inwieweit stimmen Sie folgenden Aussagen zu:

	Stimme nicht zu	Stimme eher nicht zu	Weder noch	Stimme eher zu	Stimme zu
Die Interaktion mit dem mobilen Meldedienst wäre für mich einfach zu verstehen.	○	○	○	○	○
Die Benutzung eines mobilen Meldedienstes wäre kein großer Aufwand für mich.	○	○	○	○	○
Insgesamt denke ich, dass ein mobiler Meldedienst einfach zu bedienen wäre.	○	○	○	○	○
Ich finde es umständlich einen mobilen Meldedienst zu benutzen.	○	○	○	○	○

Inwieweit stimmen Sie folgenden Aussagen zu:

	Stimme nicht zu	Stimme eher nicht zu	Weder noch	Stimme eher zu	Stimme zu
Ein mobiler Meldedienst würde Zeit bei der Meldung von Infrastrukturproblemen sparen.	○	○	○	○	○
Mit einem mobilen Meldedienst können Infrastrukturprobleme an Ort und Stelle gemeldet werden.	○	○	○	○	○
Durch einen mobilen Meldedienst können mehr Infrastrukturprobleme gemeldet werden.	○	○	○	○	○
Insgesamt finde ich einen mobilen Meldedienst nützlich für meine Stadt.	○	○	○	○	○
Ich denke, dass ein mobiler Meldedienst in meiner Stadt ineffektiv wäre.	○	○	○	○	○

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[78%]

5. Nutzungsabsicht

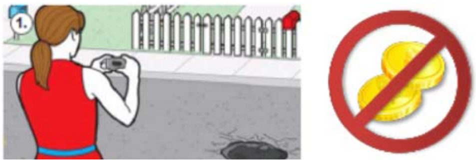
Nehmen Sie an, dass Ihre Kommune einen mobilen Meldedienst anbietet und Sie über ein entsprechendes Endgerät verfügen.

Inwieweit stimmen Sie folgenden Aussagen zu:

	Stimme nicht zu	Stimme eher nicht zu	Weder noch	Stimme eher zu	Stimme zu
Ich kann mir vorstellen, den mobilen Meldedienst zu nutzen.	○	○	○	○	○
Ich denke darüber nach, den mobilen Meldedienst zu nutzen.	○	○	○	○	○
Ich beabsichtige, den mobilen Meldedienst zu nutzen.	○	○	○	○	○

Nehmen Sie an, dieser Dienst ist kostenfrei.

Wie oft würden Sie diesen mobilen Meldedienst im Jahr nutzen?



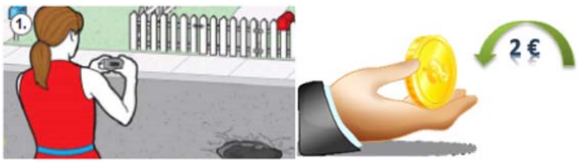
Bitte geben Sie eine geschätzte durchschnittliche Anzahl ein.

[   ] mal pro Jahr

Nutzung mit zusätzlichem Anreiz

Nun stellen Sie sich vor, Sie *erhalten 2 Euro* für jedes gemeldete Problem.

Wie oft würden Sie diesen mobilen Meldedienst im Jahr nutzen?



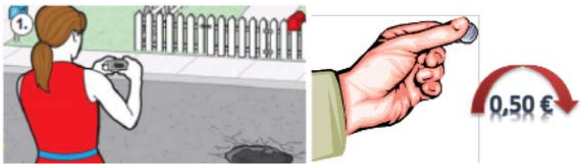
Bitte geben Sie eine geschätzte durchschnittliche Anzahl ein.

[   ] mal pro Jahr

Zahlungspflichtige Nutzung

Zum Abschluss stellen Sie sich vor, der Dienst *kostet 0,50 Euro* pro gemeldetem Problem.

Wie oft würden Sie diesen mobilen Meldedienst im Jahr nutzen?



Bitte geben Sie eine geschätzte durchschnittliche Anzahl ein.

[   ] mal pro Jahr

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[89%]

6. Demographische Angaben

Als Ihr Land haben Sie angegeben: "0"
In welchem Bundesland / welcher Region leben Sie?

- Bitte wählen Sie -

Andere Region:

Bitte geben Sie die Anzahl der Einwohner in Ihrer Stadt an:

- Bitte wählen Sie -

Ihr Alter:

Jahre

Ihr Geschlecht:

männlich weiblich

Ihre gegenwärtige Tätigkeit:

- Bitte wählen Sie -

Andere Tätigkeit:

Vielen Dank für Ihre Teilname an der Studie!

Wenn Sie die Ergebnisse dieser Studie erhalten möchten, dann tragen Sie bitte hier Ihre E-Mail Adresse ein

Email (optional):

Sie haben hier die Möglichkeit, Ihre Fragen und Anregungen zu hinterlassen:

Um die Ergebnisse zu sichern klicken Sie bitte auf "Weiter".

3 Urban Sensing Simulation Model (Scripts)

```
DIFFUSION MODEL
new potential adopters = increase of mobile users in city * potential
  user share
Potential adpoters = INTEG (new potential adopters - new
  adopters,city population * percentage mobile users * potential user
  share)
new adopters = IF THEN ELSE (Time >= implementation time, innovators
  + imitators, 0)
Adopters of the service = INTEG (new adopters, 0)
innovators = Potential adpoters * innovator rate
imitators = imitator rate * Adopters of the service * probability
probability = Potential adpoters / (Potential adpoters + Adopters of
  the service)
Non adopters = city population - Adopters of the service
```

```
DETERIORATION MODEL
total new issues = new issues per km * street network size
total potential issue spots = max spots per km * street network size
issue density = Undetected spots / total potential issue spots
new spots with issues = total new issues * (1 - issue density)
Undetected spots = INTEG (new spots with issues-new reported spots,0)
```

```
REPORTING MODEL
reports from citizen = reports from adopters + reports via
  traditional way
issue spots found by citizen = Undetected spots * (1-(1-(1/Undetected
  spots))^reports from citizen)
total walking km per month = number of inspectors * walking km per
  inspector
issue spots found by inspectors = Undetected spots * (total walking
  km per month/street network size)
new reported spots = issue spots found by citizen + issue spots found
```

```
  by inspectors - issue spots found by citizen * issue spots found by
  inspectors / Undetected spots
Issue detection rate = new reported spots / Undetected spots
Reported spots = INTEG (new reported spots-repaired spots, 0)
repaired spots = Reported spots / repair duration
```

```
COST MODEL
costs for mobile service = IF THEN ELSE( Time> = implementation time,
  (IF THEN ELSE(Time = implementation time, implementation costs,
  ongoing costs)),0)
costs for reporting = (costs per mobile report*reports from
  adopters)+(costs per traditional report*reports via traditional
  way)
costs of inspectors = cost per inspector per month*number of
  inspectors
monthly costs = costs for mobile service+costs for reporting+costs of
  inspectors
```

4 Workshop Documentation (Excerpt)

LANDESHAUPTSTADT SAARBRÜCKEN

Institut für Wirtschaftsinformatik
Humboldt-Universität zu Berlin

AGENDA

Nr.	Zeit	Agendapunkt		Moderation
1.	9:30	Begrüßung, Vorstellungsrunde und Erwartungen an den Workshop		Weinberg
2.	9:45	Präsentation bisheriger Arbeiten im Bereich mobiler Meldedienste • Wirtschaftlichkeitsanalyse • Prototypische Implementierung (inkl. Live-Demo)		Winkler, Eckert und Junghanns
3.	10:15	Aufgabenstellung für die Arbeit in Teilgruppen • Vorstellung Ist-Prozess		Winkler
4.	10:30	Teilgruppe A: Prozessmodellierung • Besprechung von IST-Prozessen der städtischen Instandhaltung • Erarbeitung von SOLL-Prozess mit mobilem Meldedienst	Teilgruppe B: Aspekte der Umsetzung • Informationsobjekte • Rechtliche Aspekte (Datenschutz) • Technische Umsetzung	A: Eckert B: Junghanns
	12:30	Mittagspause		
5.	13:30	• Gegenseitige Vorstellung der Ergebnisse aus den Teilgruppen (jew. 5 min.) • Zuordnung der Umsetzungsaspekte auf den SOLL-Prozess		Winkler
6.	14:00	Zusammenfassung • Nächste Schritte • Verabschiedung		Winkler, Weinberg
	14:30	Ende des Workshops		

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Es gibt bereits eine Reihe von Anbietern derartiger Dienste – Die Akzeptanz in Deutschland ist allerdings überschaubar

Marktüberblick

Name (Land)	Betreiber	Unterstützte Plattformen	Monatl. Kosten	Kommetar
NY311 (USA)	Öffentl.	Webseite, iPhone	n.bek.	Nur New York
Seeclickfix (USA)	Privat	Webseite, BlackBerry, iPhone, Android	Pro Verion: 29 Euro Plus Version: 72 Euro/ 100k Einwohner Connect Version: n. bek.	Nur USA
Citysourced (USA)	Privat	Webseite, BlackBerry, iPhone, Android, Windows Phone 7	n.bek.	Nur USA
Fixmystreet (GB)	Öffentl./ Privat	Webseite, iPhone, Android	kostenfrei	Community-Plattform, kein Redaktionssystem
Mängelmelder (D)	Privat	Webseite, iPhone	n.bek.	Bürger müssen sich registrieren
Mark-a-Spot (D)	Privat	Webseite, iPhone, Android, BlackBerry, PalmOS, Windows Phone, Symbian, MeeGo, bada	Community Vers. kostenfrei, Enterprise Vers. ab 3178 Euro, Updates + Hosting: 119 Euro	Bisher geringe Verbreitung
Maerker Brandenburg (D)	Öffentl.	Webseite	n.bek.	Nur Brandenburg, keine mobile Lösung

Seite 3 © HU-IWI 2011 · Eckert, Junghanns, Winkler

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Eine Modellrechnung zeigt, dass die Stadt Saarbrücken durch einen solchen Dienst pro Monat ca. 5-10% mehr Probleme auffinden könnte

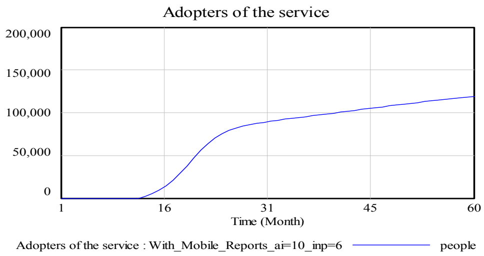
Wirtschaftlichkeitsanalyse

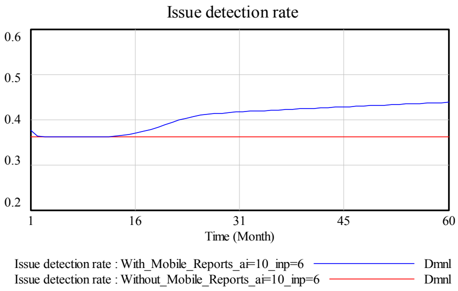
Modellannahmen

- 175.000 Einwohner
- 6 Inspektoren („Straßenläufer")
- 665 km Strassennetz
- 10% der Handybesitzer senden einmal im Jahr eine Meldung
- Überlagerung von Meldungen berücksichtigt

Modellergebnis

- Mögliche Verbesserung der Problemfindungsrate um 5-10%
- Einschränkung: Auswirkungen auf die Schadensbehebung nicht berücksichtigt





Seite **4**

LANDESHAUPTSTADT SAARBRÜCKEN

Prozesse - Übersicht

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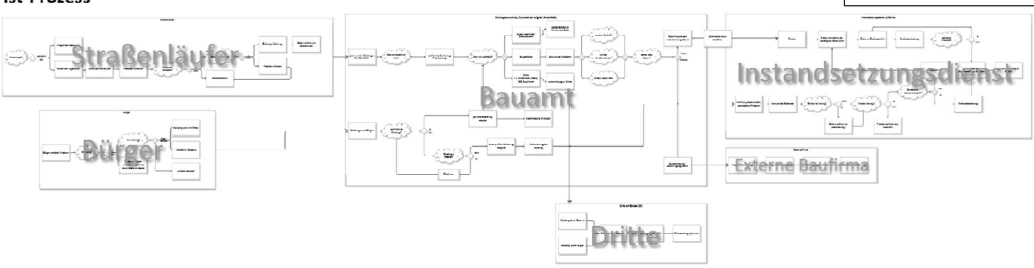
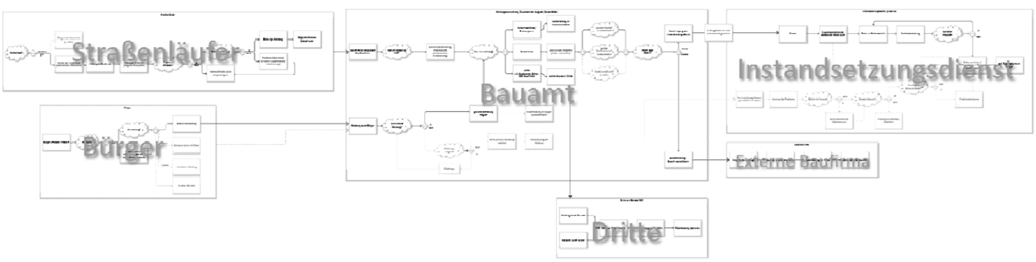
Humboldt-Universität zu Berlin

Workshop-Ergebnis

Ist-Prozess



Soll-Prozess (unterstützt durch mobile Anwendung(en))



(Veränderungen gegenüber Ist-Prozess sind grün eingefärbt bzw. ausgegraut)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Beim Thema Vorfall-Meldung durch Bürger sind eine Reihe von Stellen involviert
Backup: Organisatorische Sicht
HAUPTDEZERNAT I
Oberbürgermeisterin Charlotte Britz
Tel. 905-1600
DEZERNAT FÜR FINANZEN II
Bürgermeister Ralf Latz
Tel. 905-1440
DEZERNAT FÜR UMWELT MIGRATION UND RECHT III
Beigeordneter Kajo Breuer
Tel. 905-1748
DEZERNAT FÜR BILDUNG KULTUR UND WISSENSCHAFT IV
Beigeordneter Erik Schrader
Tel. 905-1730
BAUDEZERNAT VI
Beigeordnete Dr. Rena Wandel-Hoefer
Tel. 905-4055
DEZERNAT FÜR BÜRGERDIENSTE SICHERHEIT, SOZIALES UND SPORT VII
Beigeordneter Harald Schindel
Tel. 905-1306
Zentrale Beschwerdestelle
„Eingreiftruppe“ → Beschilderung
Straßenerhaltung

5 SaaS Interview Guideline (Shortened)

- **Einführung**
  - Willkommen und vielen Dank dass Sie sich die Zeit nehmen
  - Wer ich bin
  - Hintergrund des Interviews
  - Struktur des Interviews
  - Fragen und wie antworten
  - Vertraulichkeitsvereinbarung
- **Kontext (Context)**
  - Wie würden Sie Ihre Position in Ihrer Organisation beschreiben
  - Wie kann ich mir die IT in Firma XY in etwa vorstellen
  - Was ist Ihre Erfahrung mit SaaS
- **Entscheidung (Adoption)**
  - Seit wann wird Salesforce CRM in Ihrem Unternehmen eingesetzt?
  - Wie war die Situation vorher?
  - Gibt es weitere SaaS Produkte?
  - Was war die Motivation zur Einführung?
  - Was waren die Vorbehalte gegen eine Einführung?
  - Können Sie (heute noch) den Auswahl- und Entscheidungsprozess für die SaaS-Software beschreiben?
- **SaaS-Einführung (Adoption)**
  - Können Sie kurz schildern wie die Einführung von Salesforce von statten ging?
  - Inwieweit unterschied sich die Einführung von der einer On-premise Software?
  - Gab es bestimmte Dinge die bei der Einführung nicht unmittelbar bedacht worden sind und dann mittelfristig verändert werden mussten?
- **SaaS-Auswirkungen – Kurzfristige Veränderungen (Impact)**
  - Wie würden Sie generell die wichtigsten Auswirkungen der Nutzung von Salesforce als SaaS-Produkt beschreiben?
  - Waren mehr Änderungen auf IT Seite oder auf Fachseite notwendig?
  - Welche organisationalen Maßnahmen waren auf IT- und Fachseite notwendig, um die SaaS-Software einzuführen – insbesondere im Unterschied zu "herkömmlicher" Software?
  - Wenn sie diese Änderungen mit herkömmlicher "on-premise" Software vergleichen, inwiefern würden Sie dort einen Unterschied sehen?
- **SaaS-Auswirkungen – Langfristige Veränderungen (Impact)**
  - Welche langfristigen Veränderungen gibt es durch Nutzung der SaaS-Software?

  - Haben sich darüber hinaus mit Einführung von SaaS langfristige organisationale Veränderungen innerhalb der IT bzw. zwischen IT und Business ergeben?
  - Wenn ja, welche? (In den oben gegebenen Kategorien)
  - Hat sich das Budget für Applikationen durch SaaS geändert? In welche Richtung?
  - Hat sich die soziale Integration zwischen Business und IT verändert?
  - Hat sich die Rolle der gesamten IT durch die SaaS-Nutzung verändert? Inwiefern?
  - Hat die Einführung von der ersten SaaS-Lösung (Salesforce) zur Folge, dass das Business (auch) in Zukunft stärker auf on-Demand Lösungen setzen möchte?
  - Ist die Gesamt-Entscheidungshoheit durch SaaS stärker ins Business gerutscht?
  - Änderungen im Verhältnis mit dem Supplier (Salesforce) – im Vergleich zu anderer Software
- **Ergebnis (Success)**
  - Inwieweit wurden die Ziele, die durch die Nutzung von SaaS angestrebt wurden, erreicht? (Punkte von oben aufgreifen!)
  - Inwieweit konnten Kosten eingespart werden?
  - In welchem Bereich? Wie hoch?
  - Wie erfolgreich würden Sie die Einführung der SaaS-Software insgesamt bewerten?
- **Schluss**
  - Gibt es sonst noch Anmerkungen von Ihrer Seite / Aspekte die wir bisher nicht berührt haben, die aber von Ihrer Seite aus wichtig erscheinen?
  - Gibt es noch jemanden in Ihrer Organisation, mit dem wir zu diesem Thema sprechen sollten?
  - Vielen Dank für Ihre Zeit und Bereitschaft
  - Die Ergebnisse der Studie werden wir Ihnen gerne zukommen lassen.

6 Business and Information Technology Survey (Supplements)

6.1 Cover Letter

Business and Information Technologies
Studie 2011

«Firma»
«AdresseTitel» «Vorname» «Nachname»
«Position»
«AdrZeile1»
«AdrZeile2»

12. April 2011

Sehr «AnredeGeehrt» «AnredeHerrFrau» «AnredeTitel» «Nachname»,

wir möchten Sie herzlich einladen, an der diesjährigen **Business and Technologies Studie (BIT)** teilzunehmen, die gemeinsam von European School of Management and Technology (ESMT) und Humboldt-Universität zu Berlin durchgeführt wird.

BIT wurde 2003 ins Leben gerufen und hat sich seitdem zu einer der führenden internationalen und industrieübergreifenden IT-Management-Studien entwickelt. Langfristiges Anliegen des BIT-Projektes ist es, die Auswirkungen neuer Informations- und Kommunikationstechnologien auf Unternehmenspraktiken weltweit zu untersuchen.

Die diesjährige Studie setzt einen Schwerpunkt auf das Thema IT-Industrialisierung am Beispiel von Software-as-a-Service (SaaS). Ziel ist herauszufinden, inwieweit sich durch die Nutzung von SaaS, im Vergleich zu traditionellen sogenannten "On-premises"-Anwendungen, IT-Verantwortlichkeiten und die Rolle des Fachbereichs verändern.

Das Ausfüllen des Fragebogens nimmt **ca. 45 Minuten** in Anspruch. Er gliedert sich in folgende neun Abschnitte:

I. Unternehmens- und Teilnehmerprofil
II. Geschäftsziele und Gesamtorganisation
III. IT-Ziele und IT-Organisation
IV. SaaS/On-premise Anwendungsbeispiel *(Schwerpunktthema)*
V. Outsourcing von IT- und Geschäftsprozessen
VI. Technologieeinführung
VII. Geschäftsergebnisse und Geschäftspartner *(Wahlteil)*
VIII. Kundenseitige Beziehungen *(Wahlteil)*
IX. Arbeitsplatz und Organisation *(Wahlteil)*

Alle Informationen werden selbstverständlich **streng vertraulich** behandelt und nur anonymisiert ausgewertet. Sollten Sie Fragen zum Ausfüllen des Fragebogens haben, wenden Sie sich bitte an nebenstehende Kontaktpersonen. Sie können ebenfalls gerne die Möglichkeit wahrnehmen, den Fragebogen (auf Deutsch oder Englisch) online zu beantworten unter der Web-Adresse: **www.unipark.de/uc/bit**
Das Zugangspasswort hierfür lautet: **bitstudie**

Als **Dankeschön** für Ihre Teilnahme vergeben wir **100 Handy-Notfall-Ladegeräte** an die ersten Einsender und verlosen ein neues **Apple iPad 2** unter allen Teilnehmern, die den Fragebogen ordnungsgemäß ausgefüllt haben. Zudem stellen wir Ihnen gerne die Ergebnisse der Studie zur Verfügung. Hinterlassen Sie hierfür bitte Ihre Kontaktdaten auf der Rückseite des Fragebogens.

Wir sind Ihnen sehr dankbar, dass Sie die Zeit zum Ausfüllen dieses Fragebogens finden, und wissen Ihre Mühen zu schätzen.

Mit freundlichen Grüßen,

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6.2 Questionnaire

BIT

Business and Information Technologies Studie 2011 / Fragebogen

Bitte senden Sie diesen Fragebogen ausgefüllt bis zum 15. Mai 2011 an die rückseitig stehende Adresse. Sie können ebenfalls gerne online an der Studie teilnehmen unter: www.unipark.de/uc/bit
Das Zugangspasswort lautet: bitstudie

Unternehmens- und Teilnehmerprofil

I.a Unternehmensprofil

1. Bitte wählen Sie die **Branche** Ihres Unternehmens

   (Wählen Sie die am besten zutreffende Alternative aus)

- Automobilbau & Zulieferer
- Banken
- Bauwesen & Immobilien
- Chemie & Pharma
- Dienstleistungen
- Einzelhandel
- Elektronik & High-Tech
- Energie & Versorger
- Gesundheit
- Lebensmittel & Landwirtschaft
- Logistik & Transport
- Maschinenbau
- Metall & Rohstoffe
- Öffentliche Verwaltung
- Telekommunikation & Medien
- Textil & Mode
- Tourismus & Gastronomie
- Versicherungen
- Andere (bitte nachfolgend angeben)

2. Bitte beschreiben Sie die **Hauptaktivitäten** Ihres Unternehmens kurz in eigenen Worten

3. Bitte ordnen Sie Ihr Unternehmen anhand der folgenden Gegensatzpaare ein

   (Wählen Sie den Mittelpunkt der Skala, falls beide Begriffe gleichermaßen zutreffen)

Fertigungswirtschaft	○	○	○	○	○	Dienstleistungsbranche
Physische Produkte	○	○	○	○	○	Informationsprodukte
Business-to-Consumer	○	○	○	○	○	Business-to-Business

4. Bitte geben Sie die **Anzahl an Mitarbeitern** gesamt in Ihrem Unternehmen an sowie die **Anzahl der Mitarbeiter in der IT**

   Bei global tätigen Unternehmen / Großkonzernen: Betrachten Sie hier bitte die größtmögliche Einheit des Gesamtunternehmens, zu der Sie zuverlässig Angaben machen können (zum Beispiel: Global, nur Deutschland oder nur ein bestimmter Geschäftsbereich). Beziehen Sie Ihre Antworten für alle anderen Fragen auf genau diese Betrachtungseinheit als "Ihr Unternehmen".

   Mitarbeiter gesamt   Mitarbeiter in der IT

5. Bitte schätzen Sie den **Umsatz** und das **IT Budget** Ihres Unternehmens für das Jahr 2010 (in Millionen Euro)

   (Bei Banken und Versicherungen geben Sie bitte das Geschäftsvolumen bzw. die Beitragssumme statt eines Umsatzes an)

   Mio. EUR Umsatz   Mio. EUR IT-Budget

I.b Teilnehmerprofil

6. Bitte nennen Sie Ihre **Position oder Tätigkeitsbezeichnung** in Ihrem Unternehmen

7. Bitte geben Sie an, seit wann Sie in diesem Unternehmen arbeiten (in Jahren)

   Jahre

8. Bitte wählen Sie die **Position** innerhalb Ihres Unternehmens, welche am besten auf Ihre Tätigkeit zutrifft (horizontal und vertikal)

   ○ Fachseite   ○ IT

- Geschäftsführer / Höchster IT-Entscheider
- Geschäftsbereichsleiter / Bereichsleiter in der IT
- Führungskraft in einem Fachbereich / Führungskraft in der IT
- Mitarbeiter in einem Fachbereich / Mitarbeiter in der IT

II. Geschäftsziele und Gesamtorganisation

9. Bitte vergleichen Sie Ihr Unternehmen mit den direkten Wettbewerbern im Bezug auf die folgenden Kenngrößen
(Beispiel: Die IT-Kosten pro Mitarbeiter in Ihrem Unternehmen sind *geringer/höher/gleich* im Vergleich zu denen der Wettbewerber)

	viel geringer	geringer	etwas geringer	gleich	etwas höher	höher	viel höher
IT-Kosten pro Mitarbeiter	○	○	○	○	○	○	○
Eigenkapitalrentabilität (Gewinn / Eigenkapital)	○	○	○	○	○	○	○
Gesamtkapitalrentabilität (Gewinn / Gesamtkapital)	○	○	○	○	○	○	○
Umsatzrendite (Gewinn / Umsatz)	○	○	○	○	○	○	○
Umsatzwachstum	○	○	○	○	○	○	○

10. Bitte charakterisieren Sie die **Geschäftsstrategie** Ihres Unternehmens anhand der folgenden Gegensatzpaare

Ähnliche Märkte (Spezialisierte Produkte)	○	○	○	○	○	Unterschiedliche Märkte (Diversifizierte Produkte)
Skaleneffekte (Mengenvorteile)	○	○	○	○	○	Verbundeffekte (Cross-Selling-Vorteile)
Organisches Wachstum (Internes Wachstum)	○	○	○	○	○	Anorganisches Wachstum (Akquisitionen und Zukäufe)

11. Bitte geben Sie an, in welchen **Regionen** Ihr Unternehmen derzeit tätig ist.

	Üben derzeit Geschäftstätigkeit aus	Planen Aufnahme von Geschäftstätigkeit innerhalb der nächsten 3 Jahre	Keine Geschäftstätigkeit innerhalb der nächsten 3 Jahre
Mittel- und Osteuropa (inkl. Deutschland)	○	○	○
Westeuropa (GB, Frankreich, Spanien, usw.)	○	○	○
Nordamerika	○	○	○
Lateinamerika	○	○	○
Afrika	○	○	○
Mittlerer Osten	○	○	○
Südostasien	○	○	○

12. Bitte stufen Sie die folgenden Größen hinsichtlich der **Entscheidungsstrukturen in Ihrer Organisation** ein

	sehr gering	gering	gering-mittel	mittel	mittel-hoch	hoch	sehr hoch
Der Grad zu dem Geschäftsentscheidungen zentral vom Management getroffen werden	○	○	○	○	○	○	○
Der Grad an Freiheit, den verschiedene Geschäftsbereiche in Entscheidungen haben	○	○	○	○	○	○	○
Die Autonomie, die leitenden Verantwortlichen bei operativen Geschäftsentscheidungen gegeben wird	○	○	○	○	○	○	○

13. Bitte schätzen Sie das geschäftsspezifische Wissen und die Erfahrung der **Mitarbeiter in der IT** ein

	sehr gering	gering	gering-mittel	mittel	mittel-hoch	hoch	sehr hoch
Das **Wissen**, das IT-Mitarbeiter über die Geschäftsprozesse haben ist...	○	○	○	○	○	○	○
Die **Erfahrung**, die IT-Mitarbeiter in Aktivitäten des Kerngeschäfts haben, ist...	○	○	○	○	○	○	○

14. Bitte schätzen Sie nun das IT-Wissen und IT-Erfahrung der **Mitarbeiter in den Fachbereichen** ein

	sehr gering	gering	gering-mittel	mittel	mittel-hoch	hoch	sehr hoch
Das **Wissen**, das der Fachbereich von IT Management, Technologien und Anwendungen hat, ist...	○	○	○	○	○	○	○
Die **Erfahrung**, die Mitarbeiter im Fachbereich in IT-Projekten gemacht haben, ist...	○	○	○	○	○	○	○

III. IT-Ziele und IT-Organisation

15. Inwieweit stimmen Sie folgenden Aussagen bezüglich der **IT-Ziele** Ihres Unternehmens zu

	stimme überhaupt nicht zu	stimme nicht zu	stimme eher nicht zu	neutral	stimme eher zu	stimme zu	stimme sehr zu
Die IT sollte die vereinbarten Dienste **kosten-effizient** anbieten und liefern	○	○	○	○	○	○	○
Die IT sollte **effizient** darin sein, IT-Anwendungen zu **betreiben** und zu unterstützen	○	○	○	○	○	○	○
IT sollte dazu beitragen, die **Leistungsfähigkeit der Geschäftsprozesse** zu verbessern	○	○	○	○	○	○	○
IT sollte **Prozesskosten** und **-durchlaufzeiten** senken sowie die **Qualität** erhöhen	○	○	○	○	○	○	○
IT sollte helfen, den **Markt und die Reichweite** Ihres Unternehmens zu vergrößern	○	○	○	○	○	○	○
IT sollte die **Weiterentwicklung der Produkte** Ihres Unternehmens voran bringen	○	○	○	○	○	○	○

16. Bitte ordnen Sie die **IT-Ziele** Ihres Unternehmens zusammenfassend anhand der folgenden Gegensatzpaare ein

Gewinn optimieren	○	○	○	○	○	Wachstum erzielen
Geringe Kosten des Geschäftsbetriebs	○	○	○	○	○	Hohe Geschäftsinnovation
Betriebliche Leistungsfähigkeit	○	○	○	○	○	Strategische Positionierung

17. An wen berichtet der höchste IT-Leiter in Ihrem Unternehmen?

○ an den Geschäftsführer (CEO)
○ an den Finanzvorstand (CFO)
○ an andere, bitte hier angeben: ________

18. Falls es IT-Mitarbeiter gibt, die nicht diesem höchsten IT-Leiter unterstehen, sondern an dezentrale IT-Verantwortliche in den Fachbereichen berichten, wie hoch ist dieser **Anteil an "dezentralen" IT-Mitarbeitern**?

(Bitte geben Sie eine Zahl zwischen 0 und 100 Prozent an, gemessen an der Gesamtanzahl von IT-Mitarbeiter)

____ %

19. Wer trifft in Ihrem Unternehmen generell die wichtigsten **IT-Entscheidungen** in Bezug auf...

	Fachseite	Fachseite mit IT-Beteiligung	Fachseite und IT gemeinsam	IT mit Beteiligung der Fachseite	Zentrale IT
den **Bedarf an IT-Anwendungen** (z.B. neue Anwendungen, funktionale Anforderungen)	○	○	○	○	○
die **IT-Ausgaben** (z.B. IT-Budget und Priorisierung der IT-Investitionen)	○	○	○	○	○
die **IT-Architektur** (z.B. eingesetzte Technologien, Anbieterauswahl, Integrationsfragen)	○	○	○	○	○

20. Beurteilen Sie die **allgemeine Leistungsfähigkeit der IT-Organisation**

	sehr niedrig	niedrig	niedrig-mittel	mittel	mittel-hoch	hoch	sehr hoch
Die **Effizienz** der IT-Organisation in der Ausführung ihrer Arbeit ist...	○	○	○	○	○	○	○
Die **Qualität** der von der IT angebotenen Dienste ist...	○	○	○	○	○	○	○
Die **Unterstützung der Geschäftsprozesse** durch die IT ist...	○	○	○	○	○	○	○
Die **Zufriedenheit des Fachbereichs** mit der Arbeit der IT ist...	○	○	○	○	○	○	○

IV. SaaS/On-Premise Anwendungsbeispiel *(Schwerpunktthema)*

Definitionen: Wir verstehen **Software-as-a-Sevice (SaaS)** als *jegliche Unternehmenssoftware, die von einem externen Anbieter für viele Kundenorganisationen bereitgestellt wird und von den Mitarbeitern Ihres Unternehmens über das Internet im Web Browser genutzt werden kann.*

Im Gegensatz dazu sprechen wir von einer **On-premises-Anwendung**, *wenn die Unternehmenssoftware auf den Rechnern der Betriebsstätten Ihres eigenen Unternehmens (engl. premises) auf herkömmliche Weise installiert und betrieben wird, und diese Installation auch ausschließlich von Ihrem Unternehmen genutzt wird.*

21. Nutzt ihr Unternehmen Software-as-a-Service?

- ○ Ja
- ○ Nein

Falls *ja*, dann stellen Sie sich jetzt bitte die SaaS-Anwendung vor, die in Ihrem Unternehmen genutzt wird. Im Fall von mehreren möglichen Anwendungen, wählen Sie bitte die wichtigste oder die, mit der Sie am besten vertraut sind.

Falls *nein*, so wählen Sie bitte an eine herkömmliche, on-premises-Anwendung, die in Ihrem Unternehmen im Einsatz ist. Da hier vermutlich mehrere in Frage kommen, wählen Sie bitte die wichtigste oder die, mit der Sie am besten vertraut sind.

22. Was ist die genaue **Bezeichnung** für die von Ihnen gewählte Anwendung

23. Bitte bestätigen Sie hier hier erneut, ob es sich bei dieser Anwendung um SaaS oder On-premises handelt

- ○ SaaS
- ○ On-premises

24. Welcher **Anwendungszweck** charakterisiert diese Anwendung am besten?

- ○ Business Intelligence & Analytics
- ○ Communications & Collaboration
- ○ Customer Relationship Management (CRM)
- ○ Digital Content Creation (DCC)
- ○ Engineering & Design
- ○ Enterprise Resource Planning (ERP)
- ○ Human Resource Management (HRM)
- ○ Office- & Productivity-Anwendungen
- ○ Production Execution
- ○ Service Management
- ○ Supply Chain Management (SCM)
- ○ Andere

25. Seit wieviel Jahren nutzt Ihr Unternehmen diese Anwendung?

Jahre

26. Wie lange hatte die Einführung dieser Anwendung gedauert (von der Anbieterentscheidung bis zum Go-Live, in Monaten)?

Monate

27. Hat diese Anwendung eine vorherige Lösung abgelöst oder wurde sie als neue Lösung eingeführt?

- ○ Ablösung einer vorherigen Lösung
- ○ Einführung als neue Lösung

28. Bitte spezifizieren Sie hinsichtlich der **Einführung** dieser Anwendung...

	Fachbereich	**Fachbereich mit IT-Beteiligung**	**Fachbereich und IT gemeinsam**	**IT mit Beteiligung des Fachbereichs**	**Zentrale IT**
Aus welchem Teil der Organisation stammte die **initiale Idee**, diese Anwendung einzuführen	○	○	○	○	○
Welcher Teil der Organisation war **treibende Kraft während der Einführung** dieser Anwendung	○	○	○	○	○

29. Bitte schätzen Sie die **Anzahl der Nutzer** der genannten Anwendung

Nutzer

30. Bitte geben Sie den **Umfang der Nutzung** dieser Anwendung an

	einzelnen Org.einheiten	**mehreren Org.einheiten**	**einem Geschäfts-bereich**	**mehreren Geschäftsbereichen**	**unternehmens-weit**
Die Anwendung wird genutzt in...	○	○	○	○	○

SaaS/On-Premise Anwendungsbeispiel

31. Bitte bewerten Sie folgende **Charakteristika der Anwendung** (im Vergleich zu anderen Anwendungen in Ihrem Unternehmen)

	sehr gering	gering	gering-mittel	mittel	mittel-hoch	hoch	sehr hoch
Der Anteil an Mitarbeitern in Ihrem Unternehmen, die diese Anwendung nutzen	○	○	○	○	○	○	○
Die Häufigkeit, mit der diese Anwendung im Tagesgeschäft genutzt wird	○	○	○	○	○	○	○
Die Menge an Trainings die notwendig waren, um die Nutzer auf diese Anwendung zu schulen	○	○	○	○	○	○	○
Der Aufwand, um diese Anwendung (initial und kontinuierlich) an Ihr Unternehmen anzupassen	○	○	○	○	○	○	○
Der Grad, zu dem diese Anwendung auf die Prozesse Ihres Unternehmens angepaßt wurde	○	○	○	○	○	○	○
Der Schwierigkeitsgrad, um eine Anpassung an dieser Anwendung vorzunehmen	○	○	○	○	○	○	○
Die Anzahl von erforderlichen Mitarbeitern mit speziellen Qualifikationen, um diese Anwendung zu betreiben	○	○	○	○	○	○	○
Der Grad, zu dem diese Anwendung technisch mit der restlichen Anwendungslandschaft integriert ist	○	○	○	○	○	○	○

32. Präzisieren Sie bezüglich der letzen Frage bitte die **Anzahl und den Typ von Schnittstellen**, die diese Anwendung mit anderen Systemen hat

	Keine Schnittstelle (stand-alone)	Unidirektionale Schnittstelle (one-way)	Bidirektionale Schnittstelle (two-way)	Mehrere Schnittstellen	Hochintegrierte Anwendung
Anzahl und Typ von Schnittstellen	○	○	○	○	○

Die nun folgenden Fragen beziehen sich auf die Aufteilung von **Entscheidungs- und Aufgabenverantwortlichkeiten** zwischen Fachbereich und IT, um die genannte Anwendung zu betreiben

33. Wer entscheidet über...

	Fachbereich	Fachbereich mit IT-Beteiligung	Fachbereich und IT gemeinsam	IT mit Beteiligung des Fachbereichs	Zentrale IT
Änderungen an der Anwendung (z.B. Freigaben für Change Requests oder Anpassungen)	○	○	○	○	○
IT-Ausgaben für diese Anwendung (z.B. für Lizenzen, Erweiterungen, Wartung)	○	○	○	○	○
Architekturfragen bezüglich dieser Anwendung (z.B. Integration mit anderen Systemen, genutzte Infrastrukturkomponenten)	○	○	○	○	○

34. Wer führt die folgenden Aktivitäten durch...

(Hinweis: Falls die jeweilige Aufgabe von einem externen Unternehmen geleistet wird, vermerken Sie dies bitte in der nächsten Frage und wählen hier denjenigen Teil der Organisation, der für die Steuerung dieses Dienstleisters verantwortlich ist)

	Fachbereich	Fachbereich mit IT-Beteiligung	Fachbereich und IT gemeinsam	IT mit Beteiligung des Fachbereichs	Zentrale IT
Änderungen an der Anwendung (z.B. Umsetzung von Anpassungen und Customizing)	○	○	○	○	○
1st Level-Support für diese Anwendung (z.B. Beantwortung von Nutzeranfragen, Incident Management)	○	○	○	○	○
2nd-Level-Support für diese Anwendung (z.B. Auffinden technischer Fehler, Problembehebung)	○	○	○	○	○

35. Bitte wählen die folgenden Checkboxen an, falls eine der genannten Tätigkeiten durch einen **externen Dienstleister** erbracht wird

- ☐ **Umsetzung von Änderungen** durch externen Dienstleister
- ☐ **1st-Level-Support** durch externen Dienstleister
- ☐ **2nd-Level-Support** durch externen Dienstleister

36. Inwieweit würden Sie den folgenden Aussagen bezüglich der **Support-Organisation für die genannte Anwendung** zustimmen

(Hinweis: Je nach Beantwortung der vorangegangenen zwei Fragen kann sich der Begriff "IT-Support " sowohl auf Fachbereichs- als auch auf IT-Mitarbeiter oder Externe beziehen)

	stimme überhaupt nicht zu	stimme nicht zu	stimme eher nicht zu	neutral	stimme eher zu	stimme zu	stimme sehr zu
Der IT-Support für diese Anwendung ist für die Nutzer erreichbar und reagiert schnell	○	○	○	○	○	○	○
Der IT-Support für diese Anwendung ist zuverlässig und kompetent für die auftretenden Probleme	○	○	○	○	○	○	○
Der IT-Support versteht die Bedürfnisse der Nutzer zur Weiterentwicklung der Anwendung	○	○	○	○	○	○	○
Der IT-Support dieser Anwendung ist in der Lage, Nutzeranforderungen umzusetzen und neue Funktionalität bereit zu stellen	○	○	○	○	○	○	○
Die Nutzer der Anwendung sind zufrieden mit dem IT Support für diese Anwendung	○	○	○	○	○	○	○

37. Bitte vergleichen Sie die tatsächlichen **Ergebnisse der Nutzung heute** mit den erwarteten Ergebnissen vor der Einführung der genannten Anwendung, im Bezug auf folgende Größen

(Beispiel: Die tatsächlichen Kosten heute sind *kleiner/größer/gleich* wie die zuvor erwarteten Kosten)

	viel kleiner	kleiner	etwas kleiner	gleich	etwas größer	größer	viel größer
Die **Kosten** (Implementierung und Betrieb) für diese Anwendung	○	○	○	○	○	○	○
Der betriebliche **Nutzen** durch diese Anwendung	○	○	○	○	○	○	○
Die Auswirkungen auf das **Umsatzwachstum** durch diese Anwendung	○	○	○	○	○	○	○

V. Outsourcing von IT- und Geschäftsprozessen

38. Bitte schätzen Sie das **Budget für IT-Outsourcing (ITO)** insgesamt als Anteil des gesamten IT-Budgets für den IT-Betrieb

(Geben Sie eine Zahl zwischen 0 und 100 Prozent an)

[ ] % von IT-Budget für ITO (z.B. für Anwendungsentwicklung, Rechenzentrum, Netzwerk)

39. Bitte schätzen Sie das **Budget für Business Process Outsourcing (BPO)**, also das Auslagern kompletter Geschäftsprozesse, gemessen am Umsatz Ihres Unternehmens

(Geben Sie eine Zahl zwischen 0 und 100 Prozent an)

[ ] % von Umsatz für BPO (z.B. für Call Center, Lohnabrechnung, Buchhaltung)

40. Welche der folgenden Bereiche sind zurzeit von Ihrem Unternehmen ausgelagert? Bitte wählen Sie für jeden Bereich die am ehesten zutreffende Spalte.

	Zur Zeit nicht ausgelagert	Zur Zeit nicht ausgelagert, Auslagerung jedoch innerhalb der nächsten 3 Jahre geplant	Teilweise ausgelagert	Weitestgehend ausgelagert	Nicht zutreffend
ITO: Anwendungsentwicklung	○	○	○	○	○
ITO: Rechenzentrum	○	○	○	○	○
ITO: Netzwerk-Management	○	○	○	○	○
ITO: Daten-Management	○	○	○	○	○
ITO: Nutzerbetreuung (z.B. Help Desk)	○	○	○	○	○
BPO: Kundenbetreuung (z.B. Call Center)	○	○	○	○	○
BPO: Lohn- und Gehaltsabrechnung	○	○	○	○	○
BPO: Marktforschung	○	○	○	○	○
BPO: Buchhaltung	○	○	○	○	○
BPO: Finanzen	○	○	○	○	○
BPO: Auftragsabwicklung	○	○	○	○	○
BPO: Ausschreibungs- und Vertragsmanagement	○	○	○	○	○

VI. Technologieeinführung

41. Beschreiben Sie die **Entwicklung Ihres Budgets** über die letzten 3 Jahre für folgende IT-Investitionen Ihrer Organisation.

(Bitte wählen Sie „nicht zutreffend", falls keine der möglichen Antworten zutrifft)

	Stark gesunken	Gesunken	Unverändert	Gestiegen	Stark gestiegen	Nicht zutreffend
Service-Verträge, Serverbetrieb, Application Integration, etc.						
Software-as-a-Service / On-Demand Computing						
Auslagerung von Geschäftsprozessen (Business Process Outsourcing)						
Software: Anwendungen						
Software: Sicherheit						
Software: Betriebssysteme & Netzwerke						
Intra- und Extranet						
Hardware: Speicher						
Hardware: Sicherheit						
Kabellose Infrastruktur						
Notfallwiederherstellung						

42. Bitte beschreiben Sie den Status der Einführung und Nutzung der folgenden **Anwendungen und Technologien** in Ihrer Organisation

(Wählen Sie die am ehesten zutreffende Option)

	Gegenwärtig im Einsatz	Einführung innerhalb der nächsten 3 Jahre geplant	Keine Einführung innerhalb der nächsten 3 Jahre geplant	Nicht zutreffend
Storage Area Networks (SAN) und Network Attached Storage (NAS)				
Hard- und Software für drahtlose Netzwerke (Wi-Fi, Wireless LAN, etc.)				
Authentifizierung und Verifikation durch Dritte (Versign, etc.)				
Identitätsmanagement-Lösungen (z.B. Single Singh-On				
Überwachungssysteme				
Biometrie				
Radio Frequency Identification (RFID)				
Open Source Software				
Enterprise Resource Planning (ERP)				
Supply Chain Management (SCM)				
Enterprise Application Integration (EAI) und Middleware (auch: SOA)				
Business Process Modeling				
Business Intelligence / Data Warehouse				
Content Management				
E-Learning				
Groupware und Organisationssoftware (Lotus Notes, Exchange, etc.)				
Enterprise Instant Messaging (IM)				
Kollaborations- und Portalsoftware (Dokumenten-management, Portale, Kollaboration, etc.)				
Webseite und E-Commerce				
Social Web (Facebook-Repräsentanz)				

Vielen Dank, Sie haben hiermit den Pflichtteil der Umfrage beendet!

Von den nächsten drei Abschnitten, wählen Sie bitte *einen* Abschnitt, der am besten auf Ihr Unternehmen zutrifft, und füllen nur diesen aus

- **VII. Geschäftsergebnisse und Geschäftspartner** (zutreffend z.B. für Unternehmen der Fertigungswirtschaft) → **Seite 9**
- **VIII. Kundenseitige Beziehungen** (zutreffend für z.B. für Unternehmen, die E-Commerce nutzen) → **Seite 9 unten**
- **IX. Arbeitsplatz und Organisation** (zutreffend für alle sonstigen Unternehmen) → **Seite 11**

(Selbstverständlich dürfen Sie auch mehrere Abschnitte bearbeiten.)

Dankeschön

Vielen Dank für Ihre Teilnahme an der BIT-Studie 2011. Als kleines Dankeschön vergeben wir 100 Notfall-Ladegeräte fürs Handy an die ersten Einsender und verlosen unter allen Teilnehmern ein Apple iPad 2. Zudem stellen wir Ihnen gerne die Ergebnisse der diesjährigen Studie zur Verfügung.

Bestätigen Sie hier, falls Sie hiermit einverstanden sind und geben Sie bitte unten Ihre Kontaktdaten an (eine Weitergabe an Dritte ist selbstverständlich ausgeschlossen).

- ☐ Ja, ich möchte an der Verlosung eines Apple iPad 2 teilnehmen
- ☐ Ja, bitte senden Sie mir bitte die Ergebnisse der diesjährigen BIT-Studie zu

Name:

Unternehmen:

Adresse:

E-Mail:

Telefon (optional):

Falls Sie Fragen oder Anregungen bezüglich der Umfrage haben, können Sie uns diese gerne hier mitteilen:

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6.3 Sample Description

Preamble

The quantitative empirical research on Software as a Service conducted in this dissertation (i.e., Chapters 5.2 and 5.4) is based on a sample acquired in course of a larger survey: the Business and Information Technologies (BIT) Project 2011 in Germany. This Appendix is taken from the BIT project documentation by Winkler, Goebel, Bidault, and Günther (2013) and describes the detailed data acquisition procedures and sample characteristics.

Data Selection and Acquisition

Data for the analyzes stems from a representative survey among German businesses. The corresponding addresses were purchased from one of the leading publishers of company information in Germany. We have chosen this particular database because it provides not only comprehensive firm information but also the opportunity to address the head of IT directly by name.

We restricted the survey to heads of IT in large private sector organizations. The Germany Institute for Research on Small and Medium Enterprises defines a large company as an organization with more than 50 million Euro of revenues and more than 500 employees (IfM 2002). A major reason for this restriction was that some of the questions in the global BIT survey (e.g., those on globalization, e-commerce, governance and organization) are more likely to apply to large businesses. Industry selection was based on the 2008 edition of the German Classification of Economic Activities (WZ 2008). All industry sectors except Public Administration, Defense, Social Insurance (84), Education (85), Homes and Institutions (87-88), Private Households (97), and Extra-Territorial Bodies (99) were included. A query to the database yielded in 3,285 results, which were subsequently extracted.

The obtained contact data was cleaned and corrected. Particularly, in order to avoid duplicate contacts, multiple entries for the same company were eliminated. Missing addresses and forms for addressing the participants were completed and rectified. After the process of data cleaning was completed, we kept 2,886 contacts to be addressed in a mailing. As we considered this number appropriate to achieve the desired sample size (n >200), no further random selection or sorting was performed.

Subjects were addressed in a formal mailing containing a cover letter, a paper version of the questionnaire and a return envelope. Information regarding the survey was complemented by a reference to the web page of the German BIT project. Answers could be given either paper-based or online. The survey contained standard BIT questions as well as questions regarding the focus topic and amounted to 10 pages in length in an A4-booklet format. However, for reasons of convenience, only the focus part has been declared as mandatory. The overall survey was tested to take approximately 45 minutes to complete.

As an incentive, a small gadget to charge a mobile phone (worth 5 Euro) was offered to the first 100 respondents. Further, participants could enter a lottery for a modern tablet computer (worth 500 Euro). Therefore participants had to leave their contact details at the end of the questionnaire, as the survey itself did not contain any such information.

Invitations to participate were sent out mid April 2011, and the survey was closed end of May 2011 after a two-week extension. Two reminders were sent to the corporate email addresses of the companies, the first after two weeks and the second (final) reminder just before the extension period. Those companies that could not be reminded via email (and had not replied by then) were contacted over the phone. Out of these 1,018 reminder calls, 257 (25%) of the companies could not be reached after several trials. Another 247 (24%) of the companies stated that they were not able to participate due to time constraints or corporate policy. The majority of 429 (42%) companies agreed to accept a formal reminder via email, 73 (7%) stated that they are planning to respond to the survey (see Figure 2).

The total number of companies that reacted to our requests somehow amounted to 534 companies (19%). 29 of these companies returned the letter due to a recipient that is unknown or has left the company. 90 of the companies stated via email, letter or fax, that they were not willing or able to participate in the survey. After data cleaning, we counted 195 (6.8%) data sets from subjects that started the survey online but canceled. The remaining 220 usable responses represent an overall response rate of 7.6% (see Figure 2). Out of these usable responses, 89 (40%) came in as paper-based questionnaires which were subsequently transferred to the online tool for the analysis. 131 (60%) of the respondends directly used the online survey, out of whom 26 answered anonymously (see Figure 1).

Data cleaning was an important task to differentiate between anonymous and incomplete answers. We only kept answers from respondents who at least completed the mandatory part of the questionnaire with a low number of missing values. 75% of the remaining data records have less or equal than 3 (q_3=3) missing values (median m=1). Most of these missing values referred to fields with supposedly sensitive or unknown information which were occasionally left blank, such as IT budget or company performance.

Sample Characteristics

Respondent profiles As intended, the large majority of the respondents were high-level IT decision-makers with significant work experience. The median working time of respondents in their current company is 11.5 years. We surveyed the position of the respondent on a horizontal (business/ IT) and a vertical dimension (top/ senior/ manager/ staff level). An additional text field regarding the job position allowed for a further validity check. It revealed that many respondents rated themselves to pertain to the second or third level, even if they actually held the highest position in IT (e.g., Head of IT). Also, there were 11 cases where the respondent left this field blank, for example business executives responsible for IT (e.g., the Chief Financial Officer), or staff

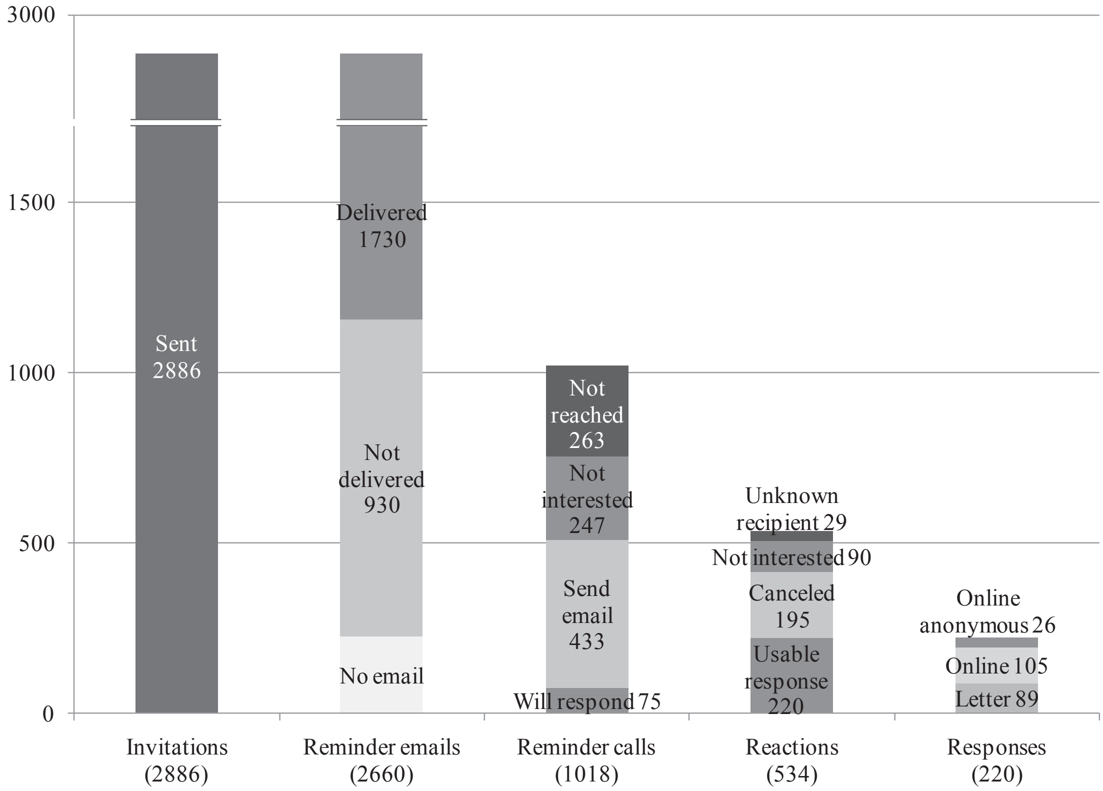

Figure 1: Survey reminders and response distribution

pertaining to an IT unit within the business organization (e.g., Demand Manager). For the purpose of evaluation, these cases have been attributed to either side based on the textual job descriptions. The distribution of work years and job positions are depicted in Figure 2.

Industry Characteristics The respondents' industries represent a good sample of the German private sector. Based on the first two digits of the Germany industry classification code (WZ 2008), we clustered the invited companies into 18 industries which had a relative frequency between 1% and 12% in our primary database (see Table 3). The participants were asked to classify their company based on this list.

Figure 4 shows the relative industry distribution of invited and respondent companies. Some deviations are notable, for example for Construction & Real Estate (positive) and Retail Trade (negative deviation). So one may conclude that these industries are rather over- or underrepresented in the sample. However, testing the observed and the expected industry frequency distribution by a chi-square test (χ=35.86; df=18; p <0.01) does not reject the null hypothesis that the observed sample is consistent with the industry distribution from the database. This speaks against a non-response bias of

Table 3: Industry classification

Classification code range	**Industry**
01; 10 – 11	Food & Agriculture
13 – 15	Textile
19 – 21	Chemicals & Pharma
24 – 25	Metal & Raw Materials
26 – 27	Electronics & High-tech
28	Mechanical Engineering
29 – 30	Automotive
35 – 38	Energy & Utilities
41 – 43; 68; 80 – 81	Construction & Real Estate
45 – 47	Retail Trade
49 – 53	Logistics & Transportation
55 – 56; 79	Tourism & Gastronomy
58 – 63	Telecommunication & Media
64	Banking
65 – 66	Insurance
69 – 78	Professional Services
86	Health Care
All other	Other

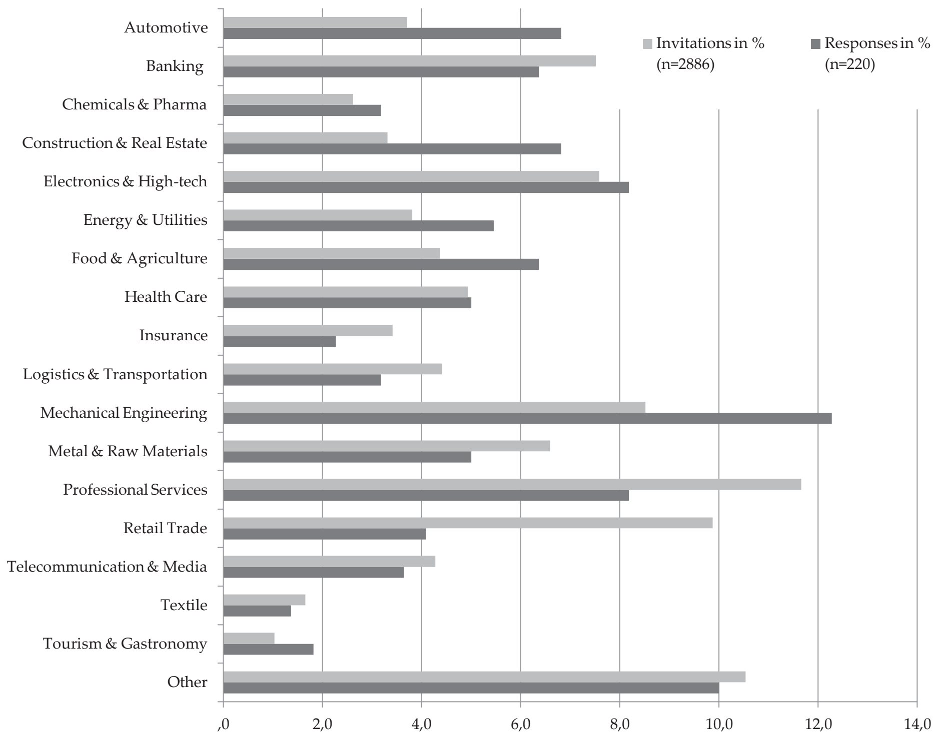

Table 4: Respondent industries

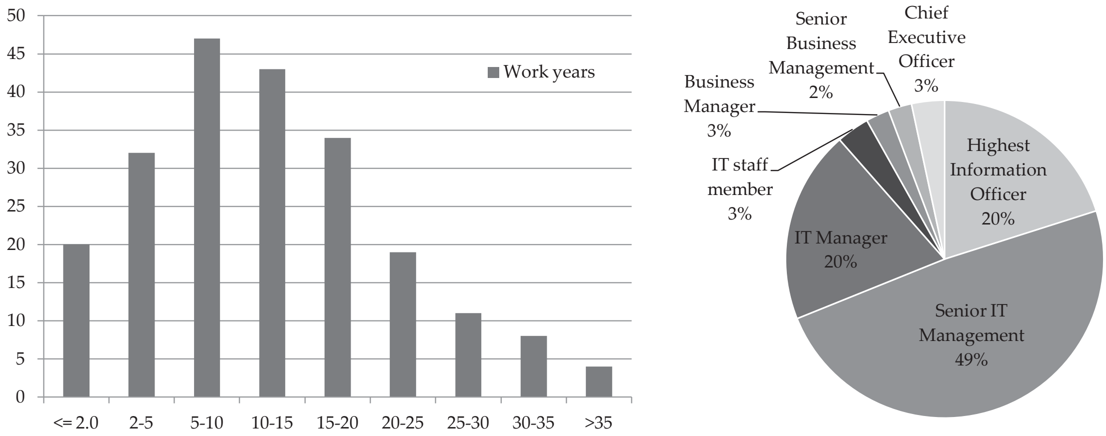

Figure 2: Respondent work years and position

certain industries in the sample.

Based on three bipolar scales we could further classify the companies according to their main business activities (Figures 4, 4, and 5). We see that 51% of respondents are from manufacturing and 41% from service industries. The 8% who do not attribute themselves to either category stem from companies who clearly have mixed activities, for example utilities that produce and distribute energy (see Figure 3).

The next question about the type of products is strongly correlating with the classification in manufacturing versus services (Spearman's rank correlation ρ=0.75). Most companies in the sample (68%) deal with physical products (like in manufacturing) rather than informational products (like in service industries). However, there are also firms producing information products, for example a software vendors, as well as service businesses who deal with physical products, e.g. retailers (see Figure 4).

Finally, we checked whether the firms in the sample rather sell to corporate or private customers. The majority (67%) focuses on business-to-business (see Figure 5). This is not surprising as most physical consumer products pass multi-tiered supply chains spanning several businesses and retailers, before reaching the end consumer.

Firm Sizes Regarding firm sizes, most companies represented in the sample are rather large, which is partly a result of our pre-selection. 91.8% of the companies have more than 500 employees, 95.3% have more than 50 milions Euros of revenues. Still, some companies fall below these thresholds as we also selected companies from the database which fulfill only one of these size criteria. The size comparison of invited (expected) and responding (observed) companies reveals that large companies have responded over-proportionally (see Figure 6). The mean of employees is much higher for respondent (m_{resp}= 4,783) than for invited firms (m_{inv}= 1,739). This difference is confirmed by a chi-square test over the employee classes, which rejects the null hypothesis of consistent distributions (χ=106.4; df=9; p <0.1). A reason for this may be that respondents themselves have

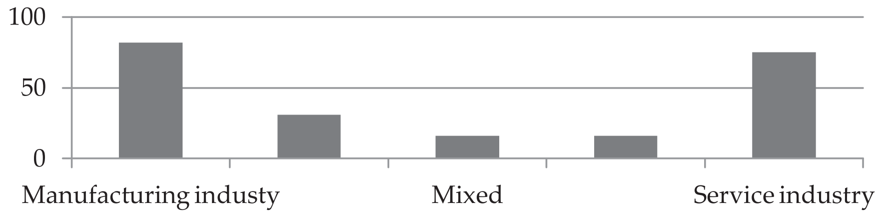

Figure 3: Manufacturing vs. service industries

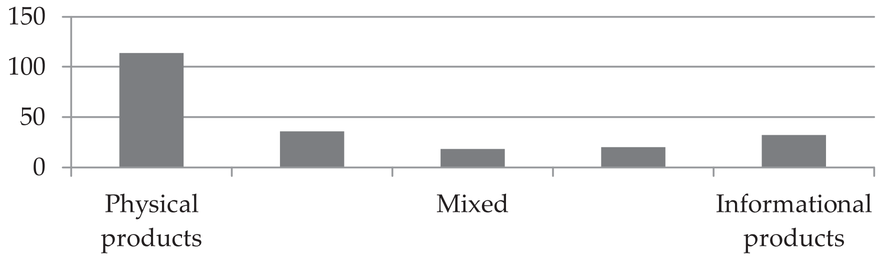

Figure 4: Physical vs. informational products

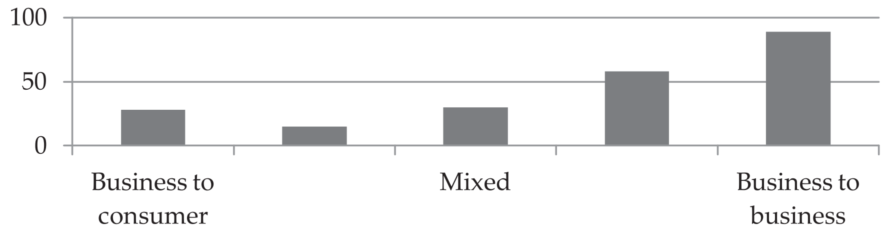

Figure 5: Business to consumer vs. business to business

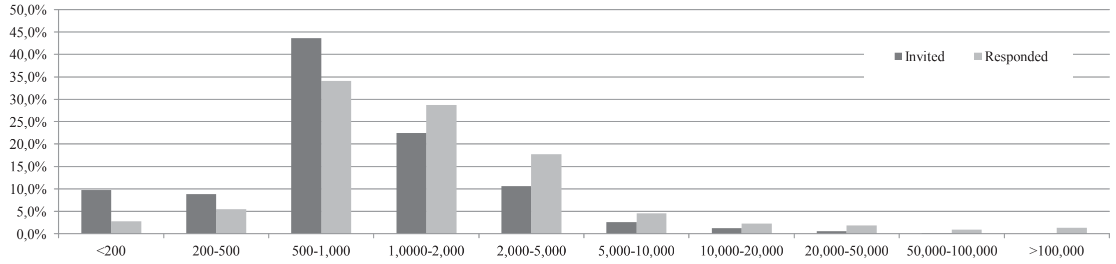

Figure 6: Employee firm sizes (invited and responded)

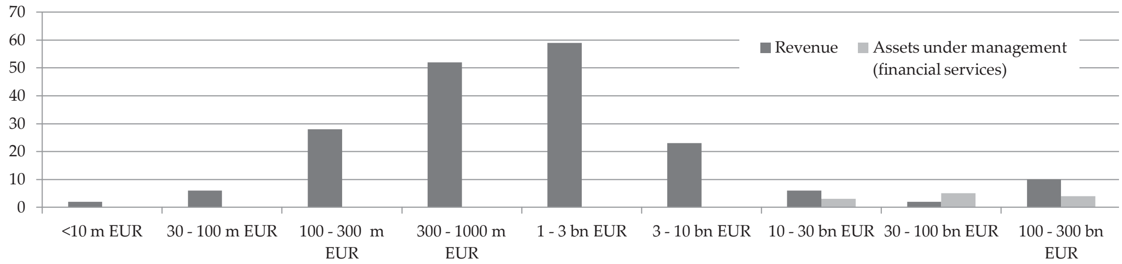

Figure 7: Financial firm size (revenues and assets under management)

recognized that the survey was directed to larger firms. Also larger firms may be more accustomed to take part in such surveys and foresee better procedures to handle such requests.

Regarding financial measures for firm size (revenues), we had to treat firms in the financial services sector separately. Since for banks and other financial institutions revenues are not an appropriate measure of firm size, we asked for the business volume measured by total assets under management of these companies. The resulting distributions are depicted in Figure 7 using pseudo-logarithmic class sizes. Managed assets are usually much higher than company revenues. The average revenue of companies in the samples is m_{Rev}= 1.442 bn and mean assets under management m_{Assets}= 11.526 bn Euros.

IT Organization Sizes Not surprising, measures describing the IT organization are strongly correlated with company size. Both, IT employees and IT budget exhibit a high and significant correlation with company employees (Pearson coefficient r=0.78 for employees, r= 0.78 for budget). On average, companies employ 2.26% of their staff in IT, and spend 1.71% of their annual revenues on IT. The distribution of IT employees and IT budget are given in Figures 8.

However, our results indicate that there are other factors explaining the level of IT investments, as well. A logarithmic regression of company employees on IT employees, respectively company revenues on IT budget only explains half of the variance in the observed IT organization sizes ($R^2{}_{empl}$= 0.52; $R^2{}_{rev}$= 0.48). Thus, it would be worth to explore further factors which explain the observed levels of IT employees and IT

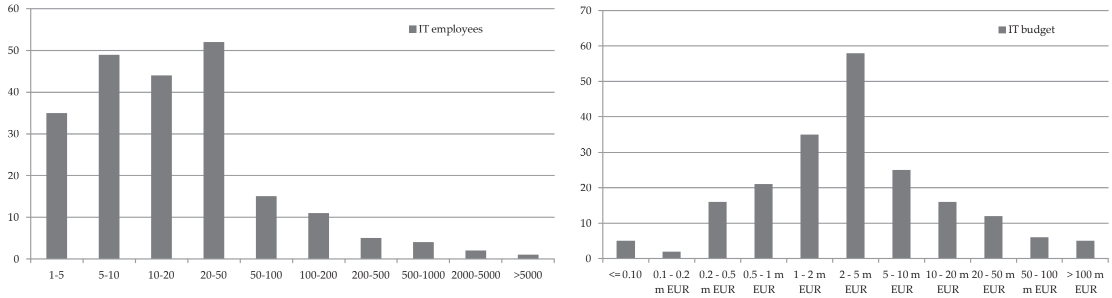

Figure 8: Histogram of IT employees and IT budget

investment. Such questions of inferential statistics shall be subject of future work.

Positioning of the CIO Finally, we also surveyed the positioning of the highest Information Officer (CIO) within the organization. Surprisingly, we find that more than 50% of the CIOs in our sample report directly to the CEO. This may reflect that at least for large companies the view has prevailed that IT needs to be governed on board level and involved in major business decisions. About a third of the CIOs resport to the CFO, which possibly represents the more conservative companies. The remaining 15% state to report to other C-level executives such as a Chief Operating Officer (COO), regional heads or the entire board, see Figure 9.

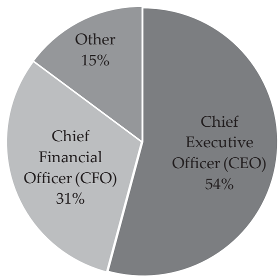

Figure 9: Position of the CIO (reports to...)

7 SaaS Adoption Processes (Enlarged)

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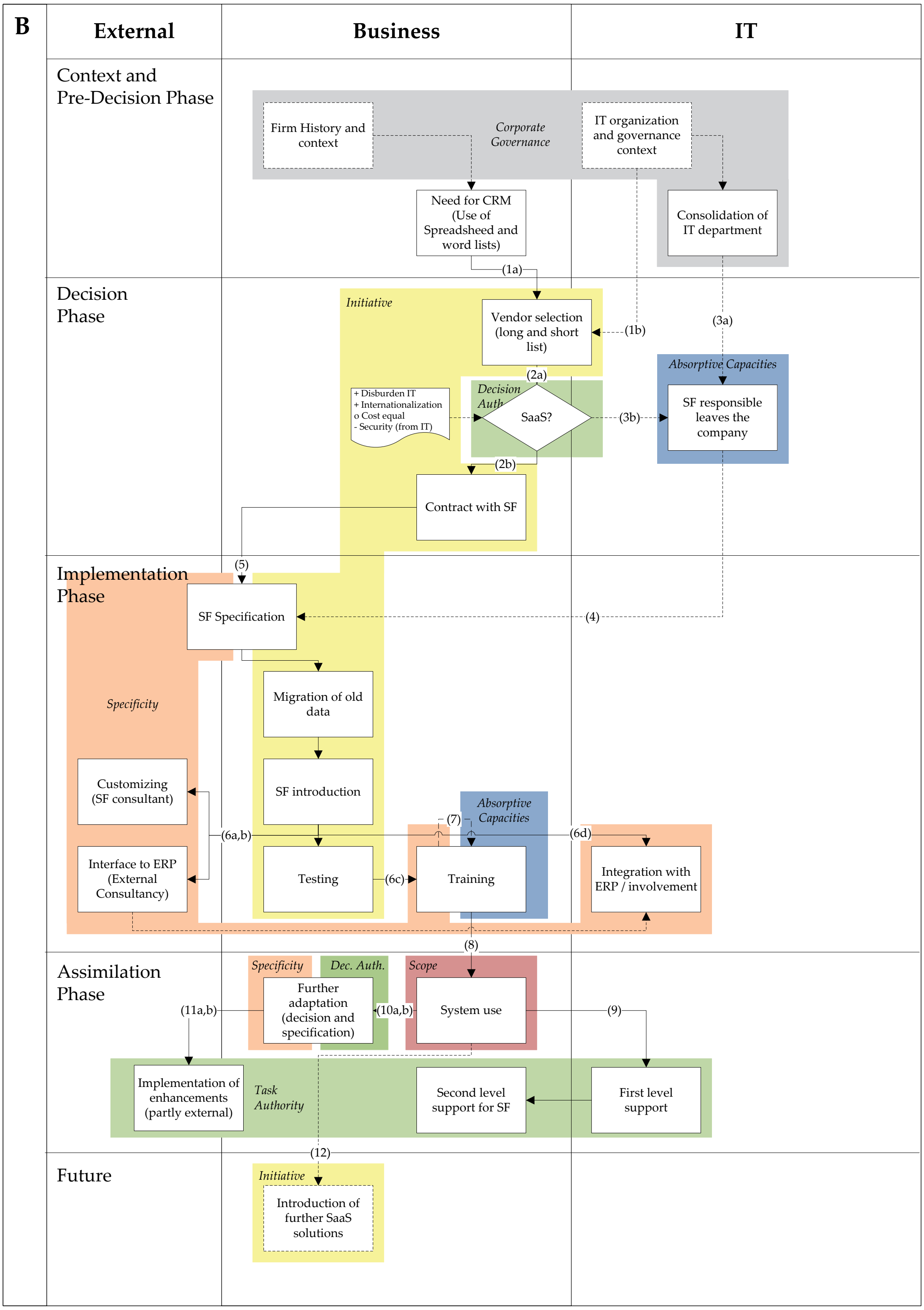

Figure 10: SaaS Adoption Process – Case B

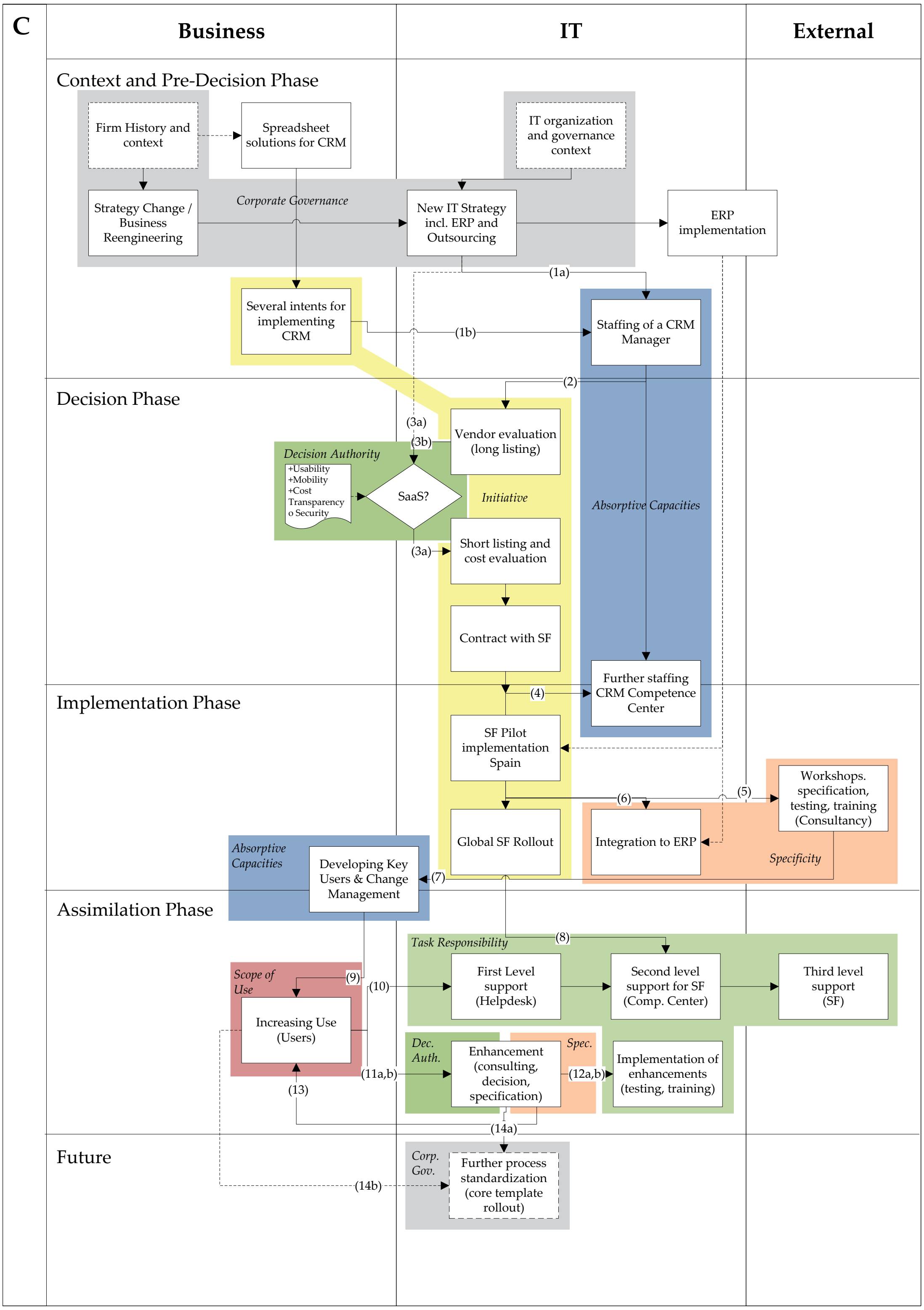

Figure 11: SaaS Adoption Process – Case C

8 Information Systems Specificity (Items and Cross-loadings)

Table 5: Items and cross-loadings

Please rate on the following characteristics of the application...	FuncSp	HumSp	TechSp	Scope	DecAuth	TaskResp
The degree to which this application has been customized to the company's processes	**.949**	.722	.493	.272	.055	.015
The effort for adapting this application to the company's needs	**.945**	.660	.517	.316	.025	.004
The amount of trainings that were provided to the users	.705	**.931**	.546	.312	.006	-.024
The need for personnel with specialized skills to manage this application	.643	**.918**	.344	.322	-.022	.007
The degree to which the application is technically integrated with other applications	.473	.386	**.945**	.522	.302	.151
The number and types of interfaces (none, one-way, two-way, several, highly-integrated)	.534	.533	**.943**	.504	.128	.027
The scope of use of this application within your company (single unit to company-wide)	.097	.111	.328	**.823**	.505	.396
The share of people in the company who use this application	.373	.410	.580	**.963**	.445	.388
Who decides on ...						
Changes to this application (e.g., approvals of a change request or customizations)	-.024	-.037	.154	.476	**.844**	.563
IT spending for this application (e.g., for licenses. enhancements. Maintenance)	.079	.039	.271	.452	**.924**	.655
Architecture issues regarding this application (e.g., integration with other systems. infrastructure)	.050	-.028	.165	.391	**.834**	.664
Who is responsible for ...						
Changes to this application (e.g.. doing customizations. implementing a change)	-.030	-.065	.037	.372	.714	**.925**
First level support for this application (e.g., answering user requests. incident management)	-.005	.020	.096	.445	.649	**.927**
Second level support for this application (e.g., finding technical errors. problem management)	.065	.019	.133	.364	.643	**.921**

Bibliography

D. Acemoglu. Introduction to economic growth. *Journal of Economic Theory*, 147(2): 545–550, 2012. (cited on p. 1)

R. Agarwal and V. Sambamurthy. Principles and models for organizing the IT function. *MIS Quarterly Executive*, 1(1):1–16, 2002. (cited on pp. 1, 13, 18, 20, and 24)

R. S. Aguilar-Savén. Business process modelling: Review and framework. *International Journal of Production Economics*, 90(2):129–149, 2004. (cited on p. 98)

S. Al-khamayseh, E. Lawrence, and A. Zmijewska. Towards understanding success factors in interactive mobile government. In *Proceedings of the Second European Conference on Mobile Government (Euro mGov) – Opportunities for eGovernment: Adapting to Mobile and Ubiquitous Business*, pages 3–5. Citeseer, 2006. (cited on pp. 5, 60, 61, and 93)

S. Albers and L. Hildebrandt. Methodische Probleme bei der Erfolgsfaktorenforschung-Messfehler, formative versus reflektive Indikatoren und die Wahl des Strukturgleichungs-Modells. *Zeitschrift für betriebswirtschaftliche Forschung*, 58 (1):2–33, 2006. (cited on p. 51)

J. Alford. Why Do Public-Sector Clients Coproduce? *Administration & Society*, 34(1): 32–56, 2002. (cited on pp. 76, 79, 80, 84, and 90)

S. Ali and P. Green. IT governance mechanisms in public sector organisations: An Australian context. *Journal of Global Information Management*, 15(4):41–63, 2007. (cited on pp. 62, 207, and 208)

K. V. Anderson and H. Z. Henriksen. The first leg of e-government research: domains and application areas 1998-2003. *International Journal of Electronic Government Research (IJEGR)*, 1(4):26–44, 2005. (cited on p. 5)

R. N. Anthony and V. Govindarajan. *Management control systems*. Management control systems. McGraw-Hill/Irwin, 12th edition edition, 2007. (cited on pp. 17 and 20)

P. M. Aoki, R. J. Honicky, A. Mainwaring, C. Myers, E. Paulos, S. Subramanian, and A. Woodruff. Common sense: Mobile environmental sensing platforms to support community action and citizen science. In *Adjunct Proceedings Ubicomp 2008*, pages Paper 201+. Human Computer Interaction Institute, 2008. (cited on pp. 90, 92, and 114)

M. Armbrust, A. Fox, R. Griffith, A. D. Joseph, R. H. Katz, A. Konwinski, G. Lee, D. A. Patterson, A. Rabkin, I. Stoica, and Others. Above the clouds: A Berkeley view of cloud computing. *EECS Department, University of California, Berkeley, Tech. Rep. UCB/EECS-2009-28*, 2009. (cited on pp. 117, 119, 138, 147, and 166)

M. Armbrust, A. Fox, R. Griffith, A. D. Joseph, R. Katz, A. Konwinski, G. Lee, D. Patterson, A. Rabkin, I. Stoica, and M. Zaharia. A view of cloud computing.

Communications of the ACM, 53(4):50–58, 2010. (cited on pp. 7 and 8)

C. P. Armstrong and V. Sambamurthy. Information technology assimilation in firms: The influence of senior leadership and IT infrastructures. *Information Systems Research*, 10(4):304–327, 1999. (cited on pp. 127, 129, and 169)

B. A. Aubert, S. Rivard, and M. Patry. A transaction cost model of IT outsourcing. *Information & Management*, 41(7):921–932, 2004. (cited on pp. 181, 186, 187, and 199)

K. Backhaus, B. Erichson, and W. Plinke. *Multivariate Analysemethoden: Eine anwendungsorientierte Einführung*. Springer, 2003. (cited on pp. 38 and 56)

J. Ballantine and S. Stray. Financial appraisal and the IS/IT investment decision making process. *Journal of Information Technology*, 13(1):3–14, 1998. (cited on pp. 94, 95, and 114)

R. Baskerville, J. Pries-Heje, and J. Venable. Soft design science research: Extending the boundaries of evaluation in design science research. *DESRIST 2007*, pages 18–38, 2007. (cited on p. 96)

F. M. Bass. A New Product Growth for Model Consumer Durables. *Management Science*, 15(5):215–227, 1969. (cited on pp. 100, 111, and 113)

G. Bassellier and I. Benbasat. Business competence of information technology professionals: conceptual development and influence on it-business partnerships. *MIS Quarterly*, 28:673–694, 2004. (cited on pp. 148, 149, 150, and 161)

G. Bassellier, I. Benbasat, and B. H. Reich. The influence of business managers' IT competence on championing IT. *Information Systems Research*, 14(4):317, 2003. (cited on pp. 127, 129, 147, 150, and 151)

R. Behara, C. D. Huang, and Q. Hu. A System Dynamics Model of Information Security Investments. *Proceedings of the 15th European Conference on Information Systems (ECIS)*, 2007. (cited on p. 95)

I. Benbasat, D. K. Goldstein, and M. Mead. The Case Research Strategy in Studies of Information Systems. *MIS Quarterly*, 11(3):369–386, 1987. (cited on pp. 34, 64, and 213)

A. Benlian and T. Hess. Chancen und Risiken des Einsatzes von SaaS – Die Sicht der Anwender. In A. Benlian, T. Hess, and P. Buxmann, editors, *Software-as-a-Service*, pages 173–187. Gabler, 2010a. (cited on p. 7)

A. Benlian and T. Hess. The Risks of Sourcing Software as a Service–An Empirical Analysis of Adopters and Non-Adopters. In *ECIS 2010 Proceedings*, 2010b. (cited on pp. 118, 119, and 138)

A. Benlian and T. Hess. Opportunities and risks of software-as-a-service: Findings from a survey of IT executives. *Decision Support Systems*, 52(1):232–246, 2011. (cited on p. 8)

A. Benlian, T. Hess, and P. Buxmann. Drivers of SaaS-Adoption – An Empirical Study of Different Application Types. *Business & Information Systems Engineering*, 1(5): 357–369, 2009. (cited on pp. 8, 43, 117, 118, 119, 121, 127, 128, 129, 138, 146, 150, 151, 162, 164, 181, 186, 187, 189, 190, and 199)

A. Benlian, M. Koufaris, and T. Hess. The Role of SaaS Service Quality for Continued SaaS Use: Empirical Insights from SaaS Using Firms. *ICIS 2010 Proceedings*, 2010.

(cited on pp. 118 and 119)

A. L. Bento and R. Bento. Cloud Computing: A New Phase in Information Technology Management. *Journal of Information Technology*, XXII(1):39–46, 2011. (cited on pp. 8, 26, 181, and 199)

R. Bernnat, O. Acker, N. Bieber, and M. Johnson. Friendly Takeover The Consumerization of Corporate IT. booz&co, 2010. `http://www.booz.com/media/uploads/FriendlyTakeoverVPFINAL.pdf` (accessed 7.6.2012). (cited on pp. 6 and 26)

C. P. Bezemer and A. Zaidman. Multi-tenant SaaS applications: maintenance dream or nightmare? In *Proceedings of the Joint ERCIM Workshop on Software Evolution (EVOL) and International Workshop on Principles of Software Evolution (IWPSE)*, IWPSE-EVOL '10, pages 88–92, New York, NY, USA, 2010. ACM. (cited on pp. 187 and 189)

S. Biazzo. Process mapping techniques and organisational analysis: Lessons from sociotechnical system theory. *Business Process Management Journal*, 8(1):42–52, 2002. (cited on p. 103)

Bitkom. Internet per Handy erobert den Massenmarkt, 2010. `http://www.bitkom.org/de/presse/8477_64819.aspx` (accessed 7.6.2012). (cited on p. 41)

C. Borucki, S. Arat, and I. Kushchu. Mobile government and organizational effectiveness. In *Proceedings of the First European Conference on Mobile Government, Brighton, UK: Mobile Government Consortium International*, pages 56–66, 2005. (cited on pp. 60, 61, 62, and 94)

M. C. Boudreau and D. Robey. Organizational transition to enterprise resource planning systems: theoretical choices for process research. In *Proceedings of the 20th international conference on Information Systems*, ICIS '99, pages 291–299, Atlanta, GA, USA, 1999. Association for Information Systems. (cited on pp. 169 and 170)

M.-C. Boudreau, D. Gefen, and D. W. Straub. Validation in Information Systems Research: A State-of-the-Art Assessment. *MIS Quarterly*, 25(1):1+, 2001. (cited on p. 30)

F. Bousquet and C. Le Page. Multi-agent simulations and ecosystem management: a review. *Ecological Modelling*, 176(3-4):313–332, 2004. (cited on pp. 39 and 40)

A. C. Boynton, G. C. Jacobs, and R. W. Zmud. Whose responsibility is IT management. *Sloan Management Review*, 33(4):32–38, 1992. (cited on pp. 15 and 20)

S. C. Brailsford, P. R. Harper, B. Patel, and M. Pitt. An analysis of the academic literature on simulation and modelling in health care. *Journal of Simulation*, 3(3): 130–140, 2009. (cited on p. 40)

A. E. Brown and G. G. Grant. Framing the frameworks: A review of IT governance research. *Communications of the AIS*, 15:696–712, 2005. (cited on pp. 2, 3, 14, 15, 20, 24, 149, 198, 206, and 208)

C. V. Brown. Examining the Emergence of Hybrid IS Governance Solutions: Evidence From a Single Case Site. *Information Systems Research*, 8(1):69–94, 1997. (cited on pp. 118, 138, 142, 144, 150, 184, 198, 206, and 208)

C. V. Brown. Horizontal Mechanisms under Differing IS Organization Contexts. *MIS Quarterly*, 23(3):421–454, 1999. (cited on pp. 16, 17, 20, 21, 62, 143, 144, 166, and 167)

C. V. Brown. The IT Organization of the Future. In J. N. Luftman, editor, *Competing in the Information Age: Align in the Sand, 2nd ed.* Oxford University Press, 2003. (cited on pp. 13, 18, 20, 21, 22, and 181)

C. V. Brown and S. L. Magill. Alignment of the IS functions with the enterprise: toward a model of antecedents. *MIS Quarterly*, 18(4):371–403, 1994. (cited on pp. 2, 13, 14, 15, 20, 117, 118, 120, 125, 127, 129, 130, 138, 142, 143, 148, 149, 150, 151, 180, 184, 190, 198, 204, and 208)

A. Bryman. *Social Research Methods*. Oxford University Press, 2004. (cited on p. 30)

E. Brynjolfsson. The productivity paradox of information technology. *Communications of the ACM*, 36(12):66–77, 1993. (cited on p. 1)

E. Brynjolfsson and L. M. Hitt. Information Technology and Organizational Design: Evidence from Micro Data. Technical report, MIT, 1998. (cited on pp. 2, 15, 20, and 204)

E. Brynjolfsson and L. M. Hitt. Beyond Computation: Information Technology, Organizational Transformation and Business Performance. *The Journal of Economic Perspectives*, 14(4), 2000. (cited on p. 1)

E. Brynjolfsson, Y. J. Hu, and M. D. Smith. From Niches to Riches: Anatomy of the Long Tail. *Social Science Research Network Working Paper Series*, 2006. (cited on p. 161)

J. Burke, D. Estrin, M. Hansen, A. Parker, N. Ramanathan, S. Reddy, and M. B. Srivastava. Participatory sensing. In *World Sensor Web Workshop*, pages 1–5. Citeseer, 2006. (cited on pp. 76, 80, 84, 90, 91, and 92)

T. Burns and G. M. Stalker. *The management of innovation*. Social science paperbacks. Tavistock Publications, 1966. (cited on p. 1)

A. Burton-Jones and D. W. Straub. Reconceptualizing System Usage: An Approach and Empirical Test. *Information Systems Research*, 17(3):228–246, 2006. (cited on p. 189)

N. G. Carr. IT doesn't matter. *IEEE Engineering Management Review*, 32(1):24–32, 2004. (cited on p. 7)

N. G. Carr. The end of corporate computing. *MIT Sloan Management Review*, 46(3): 67–73, 2005. (cited on pp. 139, 163, and 206)

L. Carter and F. Bélanger. The utilization of e-government services: citizen trust, innovation and acceptance factors. *Information Systems Journal*, 15(1):5–25, 2005. (cited on pp. 76, 81, 87, and 88)

L. D. Carter. *Political Participation in a Digital Age: An Integrated Perspective on the Impacts of the Internet on Voter Turnout*. PhD thesis, Virginia Polytechnic Institute and State University, 2006. (cited on pp. 80 and 84)

R. T. Cenfetelli and G. Bassellier. Interpretation of formative measurement in information systems research. *MIS Quarterly*, 33(4):689–707, 2009. (cited on p. 37)

Y. E. Chan. Why haven't we mastered alignment? The importance of the informal organization structure. *MIS Quarterly Executive*, 1(2):97–112, 2002. (cited on pp. 17 and 20)

K. Charmaz. Grounded theory. In N. K. Denzin and Y. S. Lincoln, editors, *Strategies of qualitative inquiry*, volume 2, page 249. Sage Publications, Inc, 2003. (cited on pp. 32 and 33)

I. J. Chen and K. Popovich. Understanding customer relationship management (CRM): People, process and technology. *Business Process Management Journal*, 9(5):672–688, 2003. (cited on p. 1)

W. W. Chin. Commentary: Issues and opinion on structural equation modeling. *MIS Quarterly*, 1998a. (cited on p. 36)

W. W. Chin. The partial least squares approach to structural equation modeling. In G. A. Marcoulides, editor, *Modern methods for business research*, pages 295–336. Lawrence Erlbaum, Mahwah, NJ, 1998b. (cited on pp. 37, 51, 52, 83, 84, 154, 157, 158, 191, 192, and 193)

F. Chong and G. Carraro. Architecture strategies for catching the long tail. *MSDN Library, Microsoft Corporation*, pages 9–10, 2006. (cited on pp. 138 and 161)

V. Choudhary. Comparison of Software Quality Under Perpetual Licensing and Software as a Service. *Journal of Management Information Systems*, 24(2):141–165, 2007a. (cited on pp. 119, 138, 144, and 150)

V. Choudhary. Software as a Service: Implications for Investment in Software Development. *40th Annual Hawaii International Conference on System Sciences (HICSS)*, page 209a, 2007b. (cited on pp. 7, 8, 138, and 166)

G. A. Churchill. A Paradigm for Developing Better Measures of Marketing Constructs. *Journal of Marketing Research*, 16(1):64+, 1979. (cited on pp. 35 and 190)

G. A. Churchill and D. Iacobucci. *Marketing research: methodological foundations*. South-Western Pub, 2002. (cited on pp. 35 and 36)

CIO. "State of the CIO 2008" Data Shows CIO Salaries, Influence Rising, 2008. `http://www.cio.com/article/147950/_State_of_the_CIO_2008_Data_Shows_CIO_Salaries_Influence_Rising` (accessed 7.6.2012). (cited on p. 210)

J. Cohen. *Statistical power analysis for the behavioral sciences*. Lawrence Erlbaum, 1988. (cited on p. 194)

W. M. Cohen and D. A. Levinthal. Absorptive capacity: a new perspective on learning and innovation. *Administrative science quarterly*, 35(1), 1990. (cited on pp. 119 and 127)

J. R. Commons. Institutional economics. *The American economic review*, pages 648–657, 1931. (cited on pp. 141 and 182)

Computerwoche. Zahl der mobilen Internetnutzer wird sich bis 2012 verdreifachen, 2009. `http://www.computerwoche.de/netzwerke/mobile-wireless/1898628/` (accessed 7.6.2012). (cited on p. 41)

E. M. Cronrath and A. Zock. Forecasting the Diffusion of Innovations by Analogies: Examples of the Mobile Telecommunication Market. In *International Conference of the System Dynamics Society*, pages 1–16, 2007. (cited on p. 105)

D. Cuff, M. Hansen, and J. Kang. Urban sensing: out of the woods. *Communications of the ACM*, 51(3):24–33, 2008. (cited on pp. 76, 90, and 91)

M. Cusumano. Cloud computing and SaaS as new computing platforms. *Communications* *of the ACM*, 53(4):27–29, 2010. (cited on pp. 7, 117, 119, 138, 139, 146, 166, and 181)

R. L. Daft. *Organization theory and design*. South-Western Pub, 2009. (cited on pp. 2, 14, 16, and 20)

T. H. Davenport. *Process innovation: reengineering work through information technology*. Harvard Business School Press, Boston, MA, USA, 1993. (cited on pp. 1 and 6)

T. H. Davenport and J. E. Short. *Information technology and business process redesign*, pages 1–27. Routledge, 2003. (cited on pp. 2 and 148)

R. J. David and S.-K. Han. A systematic assessment of the empirical support for transaction cost economics. *Strat. Mgmt. J.*, 25(1):39–58, 2004. (cited on p. 183)

F. D. Davis. Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. *MIS Quarterly*, 13(3):319–340, 1989. (cited on pp. 43, 77, 78, 80, 81, and 84)

F. D. Davis, R. P. Bagozzi, and P. R. Warshaw. User acceptance of computer technology: a comparison of two theoretical models. *Management science*, pages 982–1003, 1989. (cited on pp. 77, 79, 86, and 106)

S. De Haes and W. Van Grembergen. IT Governance and its Mechanisms. *Information Systems Control Journal*, 1:27–33, 2004. (cited on p. 166)

S. De Haes and W. Van Grembergen. An Exploratory Study into IT Governance Implementations and its Impact on Business/IT Alignment. *Information Systems Management*, 26(2):123–137, 2009. (cited on p. 140)

P. C. Deans. The Impact of Social Media on C-level Roles. *MIS Quarterly Executive*, 10 (4):187–200, 2011. (cited on pp. 180 and 200)

H. Demirkan, H. Cheng, and S. Bandyopadhyay. Coordination Strategies in an SaaS Supply Chain. *Journal of Management Information Systems*, 26(4):119–143, 2010. (cited on p. 138)

J. S. Denford and Y. E. Chan. Reconciling IS strategic alignment approaches. In *Proceedings of the 13th Americas Conference on Information Systems*, pages 9–12, 2007. (cited on p. 45)

R. I. Desourdis. *Emerging Public Safety Wireless Communication Systems*. Artech House Mobile Communications Series. Artech House, 2002. (cited on p. 6)

A. Diamantopoulos, M. Sarstedt, C. Fuchs, P. Wilczynski, and S. Kaiser. Guidelines for choosing between multi-item and single-item scales for construct measurement: a predictive validity perspective. *Journal of the Academy of Marketing Science*, 40(3): 1–16, 2012. (cited on pp. 36, 163, and 201)

J. Dibbern, W. W. Chin, and A. Heinzl. The Impact of Human Asset Specificity on the Sourcing of Application Services. In *European Conference on Information Systems (ECIS)*, page 114, 2005. (cited on pp. 181, 187, 188, 190, and 199)

D. V. Dimitrova and Y. C. Chen. Profiling the adopters of e-government information and services. *Social Science Computer Review*, 24(2):172–188, 2006. (cited on pp. 76, 80, and 84)

Y. Dittrich, S. Vaucouleur, and S. Giff. ERP Customization as Software Engineering: Knowledge Sharing and Cooperation. *Software, IEEE*, 26(6):41–47, 2009. (cited on pp. 146, 147, and 150)

C. Drury. *Management and cost accounting*. Cengage Learning EMEA, 2007. (cited on p. 107)

J. R. Edwards. Multidimensional Constructs in Organizational Behavior Research: An Integrative Analytical Framework. *Organizational Research Methods*, 4(2):144–192, 2001. (cited on p. 185)

P. Ein-Dor and E. Segev. Organizational Context and MIS Structure: Some Empirical Evidence. *MIS Quarterly*, 6(3):55–68, 1982. (cited on pp. 126, 127, and 129)

K. M. Eisenhardt. Agency Theory: An Assessment and Review. *The Academy of Management Review*, 14(1):57–74, 1989a. (cited on p. 140)

K. M. Eisenhardt. Building theories from case study research. *Academy of management review*, pages 532–550, 1989b. (cited on p. 34)

T. El-Kiki and E. Lawrence. Emerging Mobile Government Services: Strategies for Success. *BLED 2007 Proceedings*, page 5, 2007. (cited on pp. 60, 61, 93, and 205)

P. Ernst. Ubiquitous City Dienste in deutschen Kommunen – Attraktivität, Realisierungsstand, Treiber, Hindernisse und Ziele aus kommunaler Sicht. Master's thesis, Wirtschaftswissenschaftliche Fakultät, Humboldt-Universität zu Berlin, 2010. (cited on p. 50)

M. Essaidi. ODBIS: towards a platform for on-demand business intelligence services. In *Proceedings of the 2010 EDBT/ICDT Workshops*, EDBT '10, New York, NY, USA, 2010. ACM. (cited on pp. 146, 147, and 150)

EU. The Role of eGovernment for Europe's future [COM(2003)567]. European Commission, 2003. `http://europa.eu/legislation_summaries/information_society/strategies/l24226b_en.htm` (accessed 7.6.2012). (cited on p. 5)

J. R. Evaristo, K. C. Desouza, and K. Hollister. Centralization momentum: the pendulum swings back again. *Communications of the ACM*, 48(2):66–71, 2005. (cited on pp. 2, 13, and 204)

E. F. Fama and M. C. Jensen. Separation of Ownership and Control. *Journal of Law and Economics*, 26(2):301–325, 1983. (cited on pp. 143, 145, 150, 162, and 185)

B. Farbey, F. Land, and D. Targett. Moving IS evaluation forward: learning themes and research issues. *The Journal of Strategic Information Systems*, 8(2):189–207, 1999. (cited on pp. 94, 95, and 114)

D. F. Feeny and L. P. Willcocks. Core IS capabilities for exploiting information technology. *Sloan Management Review*, 39(3):9–21, 1998. (cited on pp. 18, 19, and 20)

W. D. Fernández. 5. The grounded theory method and case study data in IS research: issues and design. In D. N. Hart, editor, *Information systems foundations: constructing and criticising*, pages 44+. ANU E Press, 2005. (cited on pp. 33 and 213)

F. Fiedler and Others. A Contingency Model of Leadership Effectiveness. *Advances in experimental social psychology*, 1:149–190, 1964. (cited on p. 120)

M. Fishbein and I. Ajzen. *Belief, attitude, intention and behavior: An introduction to theory and research*. Addison-Wesley Reading, MA, 1975. (cited on pp. 43, 77, 78, and 79)

B. Flyvbjerg. Five Misunderstandings About Case-Study Research. *Qualitative Inquiry*,

12(2):219–245, 2006. (cited on p. 34)
C. Fornell and D. Larcker. A second generation of multivariate analysis: Classification of methods and implications for marketing research. *Review of marketing*, 51:407–450, 1987. (cited on p. 36)
C. Fornell and D. F. Larcker. Evaluating Structural Equation Models with Unobservable Variables and Measurement Error. *Journal of Marketing Research*, 18(1):39–50, 1981. (cited on pp. 53, 84, and 192)
J. W. Forrester. *Industrial Dynamics*. M.I.T. Press, Cambridge, Massachusetts, 1961. (cited on p. 95)
J. W. Forrester and P. M. Senge. *Tests for building confidence in system dynamics models*. System Dynamics Group, Sloan School of Management, Massachusetts Institute of Technology, 1978. (cited on p. 40)
M. Fowler. *Patterns of enterprise application architecture*. Addison-Wesley Professional, 2003. (cited on pp. 142 and 200)
P. Fraternali, G. Rossi, and F. Sánchez-Figueroa. Rich Internet Applications. *Internet Computing, IEEE*, 14(3):9–12, 2010. (cited on pp. 7 and 139)
G. G. Gable. Integrating case study and survey research methods: an example in information systems. *European Journal of Information Systems*, 3(2):112–126, 1994. (cited on pp. 210 and 211)
J. M. Gallaugher and Y.-M. Wang. Understanding Network Effects in Software Markets: Evidence from Web Server Pricing. *MIS Quarterly*, 26(4):303+, 2002. (cited on pp. 146 and 150)
J. Gardner. Leading into the Future. *Leading the IT Workforce in Higher Education*, page 133, 2008. (cited on p. 118)
N. Gartner. Gartner says worldwide saas revenue to grow 18 percent in 2009, 2009. `http://www.gartner.com/it/page.jsp?id=1223818` (accessed 7.6.2012). (cited on p. 8)
D. Gefen, E. Karahanna, and D. W. Straub. Trust and TAM in Online Shopping: An Integrated Model. *MIS Quarterly*, 27(1):51–90, 2003. (cited on pp. 77, 78, 79, 80, 81, 82, and 84)
F. Gens. IT Cloud Services Forecast – 2008, 2012: A Key Driver of New Growth. IDC exchange, 2008.
`http://blogs.idc.com/ie/?p=224` (accessed 7.6.2012). (cited on p. 8)
B. Glaser and A. Strauss. *The discovery of grounded theory: Strategies for qualitative research*. Aldine de Gruyter, New York, 1967. (cited on pp. 30, 32, 33, 121, and 213)
B. G. Glaser. *Theoretical sensitivity: Advances in the methodology of grounded theory*, volume 2. Sociology Press, 1978. (cited on p. 33)
B. G. Glaser. *Basics of grounded theory analysis*. Sociology Press Mill Valley, CA, 1992. (cited on pp. 63 and 122)
R. L. Glass. Enterprise resource planning–breakthrough and/or term problem? *SIGMIS Database*, 29(2):13–16, 1998. (cited on p. 187)
B. Golden. Cloud computing will cause three it revolutions – it's going to be hard to justify this man in the middle staffing. CIO.com, 2010.

http://www.cio.com.au/article/335708/cloud_computing_will_cause_three_it_revolutions/ (accessed 7.6.2012). (cited on pp. 165 and 167)

R. M. Grant. Toward a knowledge-based theory of the firm. *Strategic management journal*, 17:109–122, 1996. (cited on p. 141)

S. Gregor. The nature of theory in information systems. *MIS Quarterly*, 30(3):611–642, 2006. (cited on pp. 30 and 200)

C. Gresov. Exploring Fit and Misfit with Multiple Contingencies. *Administrative Science Quarterly*, 34(3), 1989. (cited on pp. 118, 120, 123, and 133)

A. Grönlund and T. A. Horan. Introducing e-gov: history, definitions, and issues. *Communications of the Association for Information Systems*, 15(2004):713–729, 2004. (cited on pp. 5 and 6)

M. Grottke and S. Rässler. On occupancy, coupon collector's and committee problems. Technical report, Chairs of Statistics, University of Erlangen-Nuremberg, 2003. (cited on p. 102)

B. Gu, L. Xue, and R. Ray. IT Governance and IT Investment Performance: An Empirical Analysis. *ICIS 2008 Proceedings*, page 30, 2008. (cited on pp. 117, 120, 138, 143, and 166)

O. Günther, G. Tamm, L. Hansen, and T. Meseg. Application Service Providers: Angebot, Nachfrage und langfristige Perspektiven: Elektronische Marktplätze und Supply Chain Management. *Wirtschaftsinformatik*, 43(6):555–567, 2001. (cited on p. 7)

J. Hair, C. Ringle, and M. Sarstedt. PLS-SEM: Indeed a Silver Bullet. *The Journal of Marketing Theory and Practice*, 19(2):139–152, 2011. (cited on pp. 37, 38, 154, 191, and 192)

H. H. Harman. *Modern factor analysis*. University of Chicago Press, 1976. (cited on p. 54)

J. M. Hartman, J. W. Forsen, M. S. Wallace, and J. G. Neely. Tutorials in clinical research: part IV: recognizing and controlling bias. *The Laryngoscope*, 112(1):23–31, 2002. (cited on p. 36)

A. F. Hayes. Beyond Baron and Kenny: Statistical Mediation Analysis in the New Millennium. *Communication Monographs*, 76(4):408–420, 2009. (cited on pp. 37, 194, and 195)

B. Hayes. Cloud computing. *Communications of the ACM*, 51(7):9–11, 2008. (cited on p. 7)

R. Heeks and S. Bailur. Analyzing e-government research: Perspectives, philosophies, theories, methods, and practice. *Government Information Quarterly*, 24(2):243–265, 2007. (cited on p. 5)

G. Heijkoop and S. Cunningham. Using System Dynamics for Modeling Benefit Realization in the Adoption of New Business Software. In *Proceedings of the 2007 International Conference of the System Dynamics Society*, 2007. (cited on p. 95)

J.-F. Hennart. Explaining the Swollen Middle: Why Most Transactions Are a Mix of Market and Hierarchy. *Organization Science*, 4(4):529–547, 1993. (cited on pp. 182 and 199)

J. Henseler and W. W. Chin. A Comparison of Approaches for the Analysis of Interaction Effects Between Latent Variables Using Partial Least Squares Path Modeling. *Structural Equation Modeling: A Multidisciplinary Journal*, 17(1):82–109, 2010. (cited on pp. 37 and 191)

J. Henseler, C. M. Ringle, and R. R. Sinkovics. The use of partial least squares path modeling in international marketing. *Advances in International Marketing*, 20(2009): 277–319, 2009. (cited on pp. 39 and 157)

A. R. Hevner, S. T. March, J. Park, and S. Ram. Design science in information systems research. *MIS Quarterly*, 28(1):75–105, 2004. (cited on pp. 30, 96, and 212)

D. Hoch and M. Payán. Establishing good IT governance in the public sector. *McKinsey on Government*, pages 45–55, 2008. (cited on p. 62)

G. Homburg and A. Giering. Konzeptualisierung und Operationalisierung Komplexer Konstrukte - Ein Leitfaden für die Marketing Forschung. *Marketing ZfP*, 18(1):5–24, 1996. (cited on pp. 52, 53, and 55)

P. Hoyningen-Huene. Paul Feyerabend und Thomas Kuhn. *Journal for General Philosophy of Science*, 33(1):61–83, 2002. (cited on p. 30)

R. Huang, R. Zmud, and R. Price. IT Governance Practices in Small and Medium-Sized Enterprises: Recommendations from an Empirical Study. In G. Dhillon, B. C. Stahl, and R. Baskerville, editors, *Information Systems – Creativity and Innovation in Small and Medium-Sized Enterprises*, volume 301, chapter 12, pages 158–179. Springer, Berlin, Heidelberg, 2009. (cited on pp. 20, 21, and 24)

J. Hughes and S. Jones. Reflections on the use of grounded theory in interpretive information systems research. *Electronic Journal of Information Systems Evaluation*, 6(1), 2003. (cited on pp. 33 and 213)

P. Hui, K. Xu, V. O. K. Li, J. Crowcroft, V. Latora, and P. Lio. Selfishness, Altruism and Message Spreading in Mobile Social Networks. In *INFOCOM Workshops 2009, IEEE*, pages 1–6. IEEE, 2009. (cited on p. 80)

B. Hull, V. Bychkovsky, Y. Zhang, K. Chen, M. Goraczko, A. Miu, E. Shih, H. Balakrishnan, and S. Madden. CarTel: a distributed mobile sensor computing system. In *Proceedings of the 4th international conference on Embedded networked sensor systems*, SenSys '06, pages 125–138, New York, NY, USA, 2006. ACM. (cited on pp. 90, 92, and 114)

S. D. Hunt, R. D. Sparkman, and J. B. Wilcox. The Pre-Test in Survey Research: Issues and Preliminary Findings. *Journal of Marketing Research*, 19:269–73, 1982. (cited on pp. 36 and 49)

M. G. Hunter. The Duality of Information Technology Roles. *International Journal of Strategic Information Technology and Applications (IJSITA)*, 2(1):37–48, 2011. (cited on p. 23)

IfM. Kmu-definition des ifm bonn. Institut für Mittelstandsforschung, 2002. `http://www.ifm-bonn.org/index.php?id=89` (accessed 7.6.2012). (cited on p. 257)

M. Indulska, D. S. Hovorka, and J. Recker. Quantitative approaches to content analysis: identifying conceptual drift across publication outlets. *European Journal of Information Systems*, 21(1):49–69, 2012. (cited on p. 32)

Z. Irani. Information systems evaluation: navigating through the problem domain.

Information & Management, 40(1), 2002. (cited on pp. 94 and 114)

Z. Irani, P. E. D. Love, and Others. Developing a frame of reference for ex-ante IT/IS investment evaluation. *European Journal of Information Systems*, 11(1), 2002. (cited on pp. 94 and 114)

Z. Irani, P. E. D. Love, and S. Jones. Learning lessons from evaluating eGovernment: reflective case experiences that support transformational government. *The Journal of Strategic Information Systems*, 17(2):155–164, 2008. (cited on pp. 1, 61, and 205)

R. A. Irvin and J. Stansbury. Citizen Participation in Decision Making: Is It Worth the Effort? *Public Administration Review*, 64(1):55–65, 2004. (cited on p. 76)

ITU. *Measuring the Information Society 2010.* International Telecommunication Union (ITU), Place des Nations, Geneva Switzerland, 2010. (cited on pp. 5, 60, 105, 108, and 111)

B. Iyer and J. C. Henderson. Business Value from Clouds: Learning from Users. *MIS Quarterly Executive*, 11(1):51–60, 2012. (cited on p. 27)

M. Janssen and A. Joha. Challenges for Adopting Cloud-based Software as a Service (SaaS) in the Public Sector. In *ECIS 2011 Proceedings*, pages Paper 80+, 2011. (cited on pp. 8 and 210)

M. Janssen and W. S. Shu. Transformational government: basics and key issues. In *Proceedings of the 2nd International Conference on Theory and Practice of Electronic Governance*, ICEGOV '08, pages 117–122, New York, NY, USA, 2008. ACM. (cited on pp. 60, 61, and 205)

J. S. Jasperson, P. E. Carter, and R. W. Zmud. A comprehensive conceptualization of post-adoptive behaviors associated with information technology enabled work systems. *MIS Quarterly*, 29(3):525–557, 2005. (cited on p. 180)

K. Jedidi, H. S. Jagpal, and W. S. DeSarbo. Finite-mixture structural equation models for response-based segmentation and unobserved heterogeneity. *Marketing Science*, pages 39–59, 1997. (cited on p. 39)

M. Jensen and W. Meckling. Specific and general knowledge and organizational structure. In L. Werin and H. Wijkander, editors, *Contract Economics*, pages 251–274. Blackwell, Oxford, 1998. (cited on pp. 141 and 142)

M. C. Jensen. Organization Theory and Methodology. *Social Science Research Network Working Paper Series*, 1998. (cited on pp. 145, 150, and 162)

P. Johnson, A. Kapadia, D. Kotz, N. Triandopoulos, and N. H. Hanover. People-centric urban sensing: Security challenges for the new paradigm. Technical report, Dartmouth College, Computer Science, Hanover, NH, 2007. (cited on pp. 76 and 81)

R. Johnson and D. Wichern. *Applied Multivariate Statistical Analysis.* Pearson Prentice Hall, 2007. (cited on pp. 38 and 39)

K. G. Jöreskog and H. Wold. The ML and PLS techniques for modeling with latent variables: historical and comparative aspects. In K. G. Jöreskog and H. Wold, editors, *Systems Under Indirect Observation, Part 1*, pages 263–270. Amsterdam: North-Holland, North-Holland, Amsterdam, 1982. (cited on p. 37)

M. M. Kamal. IT innovation adoption in the government sector: identifying the critical success factors. *Journal of Enterprise Information Management*, 19(2):192–222, 2006.

(cited on pp. 90 and 94)

B. Kaplan and D. Duchon. Combining Qualitative and Quantitative Methods in Information Systems Research: A Case Study. *MIS Quarterly*, 12(4):571–586, 1988. (cited on pp. 210, 211, and 212)

P. Kappelhoff. Multidimensionale skalierung. Technical report, Lehrstuhl für empirische Wirtschafts- und Sozialforschung, Schumpeter School of Business and Economics, Bergische Universität Wuppertal, 2001. (cited on pp. 38, 195, and 196)

F. Karimi-Alaghehband, S. Rivard, S. Wu, and S. Goyette. An assessment of the use of Transaction Cost Theory in information technology outsourcing. *The Journal of Strategic Information Systems*, 20(2):125–138, 2011. (cited on pp. 181, 183, 186, 187, 189, and 199)

P. G. W. Keen. Information systems and organizational change. *Communications of the ACM*, 24(1):24–33, 1981. (cited on p. 1)

M. Keil, B. C. Y. Tan, K. K. Wei, T. Saarinen, V. Tuunainen, and A. Wassenaar. A Cross-Cultural Study on Escalation of Commitment Behavior in Software Projects. *MIS Quarterly*, 24(2), 2000. (cited on pp. 39 and 157)

A. Khajeh-Hosseini, I. Sommerville, and I. Sriram. Research Challenges for Enterprise Cloud Computing.
`http://arxiv.org/ftp/arxiv/papers/1001/1001.3257.pdf` (accessed 7.6.2012), 2010. (cited on pp. 8, 181, and 199)

V. Khatri and C. V. Brown. Designing data governance. *Communications of the ACM*, 53(1):148–152, 2010. (cited on pp. 27, 138, 166, 184, and 208)

J. Kim. Causation. In R. Audi, editor, *The Cambridge Dictionary of Philosophy (2nd edition)*, pages 125–127. Cambridge University Press, Cambridge, UK, 1999. (cited on pp. 169 and 170)

J. L. King and K. Lyytinen. *Information Systems: The State of the Field (John Wiley Series in Information Systems)*. John Wiley & Sons, 2006. (cited on pp. 8, 180, and 200)

S. Kinkade and K. Verclas. Wireless Technology for Social Change: Trends in Mobile Use by NGOs. Technical report, UN Foundation: Vodafone Partnership, Washington, DC and Berkshire, UK, 2008. (cited on p. 76)

N. Kock. Using WarpPLS in e-collaboration studies: An overview of five main analysis steps. *International Journal of e-Collaboration (IJeC)*, 6(4):1–11, 2010. (cited on p. 36)

P. Kræmmergaard and J. Rose. Managerial Competences for ERP Journeys. *Information Systems Frontiers*, 4:199–211, 2002. (cited on pp. 180 and 200)

H. Krasnova and N. F. Veltri. Privacy Calculus on Social Networking Sites: Explorative Evidence from Germany and USA. In *System Sciences (HICSS), 2010 43rd Hawaii International Conference on*, pages 1–10. IEEE, 2010. (cited on pp. 81 and 88)

P. Kreutter and G. Stadtmann. The Captives' End: Lebenszyklusmuster in der Entwicklung der deutschen IT-Outsourcing-Industrie. Research notes working paper series // Deutsche Bank Research, 2009.
`http://hdl.handle.net/10419/40634` (accessed 7.6.2012). (cited on pp. 19 and 23)

H. Kromrey. *Empirische Sozialforschung*. Utb, 2006. (cited on p. 49)

J. Kruskal and M. Wish. *Multidimensional Scaling*. Quantitative Applications in the Social Sciences. Sage Publications, 1978. (cited on pp. 38 and 195)

M. Kumar and O. P. Sinha. M-government–mobile technology for e-government. In *International conference on e-government, India*, 2007. (cited on pp. 43, 60, 61, 90, and 93)

N. Kumar and R. Vragov. Active citizen participation using ICT tools. *Communications of the ACM*, 52(1):118–121, 2009. (cited on pp. 76 and 88)

V. Kumar, S. Sunder, and B. Ramaseshan. Analyzing the Diffusion of Global Customer Relationship Management: A Cross-Regional Modeling Framework. *Journal of International Marketing*, 19(1):23–39, 2011. (cited on p. 1)

I. Kushchu. *Mobile Government: An Emerging Direction in E-government*. IGI Publishing, Hershey, PA, USA, 2007. (cited on pp. 44, 45, and 93)

I. Kushchu and H. Kuscu. From E-government to M-government: Facing the Inevitable. In *the 3rd European Conference on e-Government*, pages 253–260. Citeseer, 2003. (cited on pp. 5, 6, 42, 60, 61, 78, and 93)

I. Kushchu, H. Kuscu, and B. Yu. Introducing Mobile Government. *Mobile government: an emerging direction in e-government*, page 1, 2007. (cited on pp. 60 and 61)

S. Kuznetsov and E. Paulos. Participatory sensing in public spaces: activating urban surfaces with sensor probes. In *Proceedings of the 8th ACM Conference on Designing Interactive Systems*, DIS '10, pages 21–30, New York, NY, USA, 2010. ACM. (cited on p. 76)

M. C. Lacity, S. A. Khan, and L. P. Willcocks. A review of the IT outsourcing literature: Insights for practice. *The Journal of Strategic Information Systems*, 18(3):130–146, 2009. (cited on pp. 18, 20, 182, and 185)

M. C. Lacity, L. P. Willcocks, and S. Khan. Beyond Transaction Cost Economics: Towards an endogenous theory of Information Technology Outsourcing. *The Journal of Strategic Information Systems*, 20(2):139–157, 2011. (cited on pp. 181, 187, and 199)

J. R. Landis and G. G. Koch. The Measurement of Observer Agreement for Categorical Data. *Biometrics*, 33(1):159–174, 1977. (cited on p. 123)

C. Landmark. CRM Software-as-a-Service Industry, 2011. `http://www.crmlandmark.com/saasmarket.htm` (accessed 7.6.2012). (cited on pp. 117 and 121)

N. D. Lane, S. B. Eisenman, M. Musolesi, E. Miluzzo, and A. T. Campbell. Urban sensing systems: opportunistic or participatory? In *Proceedings of the 9th workshop on Mobile computing systems and applications*, HotMobile '08, pages 11–16, New York, NY, USA, 2008. ACM. (cited on p. 92)

J. N. Lee, M. Q. Huynh, R. C. W. Kwok, and S. M. Pi. IT outsourcing evolution—: past, present, and future. *Communications of the ACM*, 46(5):84–89, 2003. (cited on pp. 7, 117, 119, and 124)

J. N. Lee, S. M. Miranda, and Y. M. Kim. IT Outsourcing Strategies: Universalistic, Contingency, and Configurational Explanations of Success. *Information Systems Research*, 15(2):110–131, 2004. (cited on pp. 18 and 20)

H. Legewie and B. Schervier-Legewie. Im gespräch: Anselm strauss. *Journal für Psychologie*, 3(1):64–75, 1995. (cited on p. 32)

P. Legris, J. Ingham, and P. Collerette. Why do people use information technology? A critical review of the technology acceptance model. *Information & Management*, 40 (3):191–204, 2003. (cited on pp. 78 and 86)

S. Lehmann, T. Draisbach, C. Koll, P. Buxmann, and H. Diefenbach. Preisgestaltung für Software-as-a-Service. *Multikonferenz Wirtschaftsinformatik 2010: Göttingen, 23.-25. Februar 2010 Kurzfassungen der Beiträge*, pages 505–516, 2010. (cited on pp. 7 and 119)

J. M. Leimeister, M. Böhm, and P. Yetton. Managing IT in a Business Unit Divestiture. *MIS Quarterly Executive*, 11:37–48, 2012. (cited on p. 22)

S. Leimeister, C. Riedl, M. Böhm, and H. Krcmar. The business perspective of cloud computing: Actors, roles, and value networks. In *Proceedings of 18th European Conference on Information Systems ECIS 2010*, 2010. (cited on p. 27)

A. Lenk, M. Klems, J. Nimis, S. Tai, and T. Sandholm. What's inside the Cloud? An architectural map of the Cloud landscape. In *Proceedings of the 2009 ICSE Workshop on Software Engineering Challenges of Cloud Computing*, volume 0 of *CLOUD '09*, pages 23–31, Washington, DC, USA, 2009. IEEE Computer Society. (cited on p. 8)

H. Liang, N. Saraf, Q. Hu, and Y. Xue. Assimilation of enterprise systems: the effect of institutional pressures and the mediating role of top management. *MIS Quarterly*, 31 (1):59–87, 2007. (cited on pp. 85, 151, 154, 157, and 193)

R. Likert. A technique for the measurement of attitudes. *Archives of Psychology*, 140 (140):1–55, 1932. (cited on p. 35)

C. Loebbecke and C. Huyskens. What drives netsourcing decisions? An empirical analysis. *European Journal of Information Systems*, 15(4):415–423, 2006. (cited on pp. 7, 181, 186, 187, and 188)

J. N. Luftman. *Managing IT Human Resources: Considerations for Organizations and Personnel.* IGI Global, 2011. (cited on pp. 19 and 20)

J. M. Lyneis, K. G. Cooper, and S. A. Els. Strategic management of complex projects: a case study using system dynamics. *System Dynamics Review*, 17(3):237–260, 2001. (cited on p. 95)

K. Lyytinen and M. Newman. Explaining information systems change: a punctuated socio-technical change model. *European Journal of Information Systems*, 17(6):589–613, 2008. (cited on pp. 1, 168, and 170)

P. Maartensson and A. S. Lee. Dialogical action research at omega corporation. *MIS Quarterly*, pages 507–536, 2004. (cited on p. 34)

L. Maciaszek. *Requirements analysis and system design.* Pearson Education, 2007. (cited on p. 109)

J. Macionis and L. Gerber. *Sociology.* Pearson Canada, 2011. (cited on p. 30)

S. B. MacKenzie, P. M. Podsakoff, and N. P. Podsakoff. Construct measurement and validation procedures in MIS and behavioral research: integrating new and existing techniques. *MIS Quarterly*, 35(2):293–334, 2011. (cited on pp. 37 and 192)

V. Mahajan, E. Muller, and F. M. Bass. Diffusion of new products: Empirical generalizations and managerial uses. *Marketing Science*, 14(3 supplement):G79–G88, 1995. (cited on pp. 105 and 108)

R. P. Mahowald, A. Konary, and C. G. Sullivan. Market Analysis Perspective: Worldwide SaaS & Cloud Services, 2011: New Models for Delivering Software. IDC, 2011. `http://www.idc.com/getdoc.jsp?containerId=232239` (accessed 7.6.2012). (cited on p. 7)

N. Maisonneuve, M. Stevens, and B. Ochab. Participatory noise pollution monitoring using mobile phones. *Information Polity*, 15(1):51–71, 2010. (cited on pp. 76, 90, 92, and 114)

S. T. March and G. F. Smith. Design and natural science research on information technology. *Decision Support Systems*, 15(4):251–266, 1995. (cited on pp. 30 and 96)

G. A. Marcoulides. A Critical Look at Partial Least Squares Modeling. *MIS Quarterly*, 33(1):171–175, 2009. (cited on pp. 37 and 51)

G. A. Marcoulides and C. Saunders. Editor's comments: PLS: a silver bullet? *MIS Quarterly*, 30(2):iii–ix, 2006. (cited on p. 37)

D. Mark and D. P. Rau. Splitting demand from supply in IT. *The McKinsey Quarterly*, (Fall):22–29, 2006. (cited on pp. 15 and 20)

E. A. Marks. *Service-oriented Architecture, Soa, Governance for the Services Driven Enterprise*. Wiley, 2008. (cited on p. 136)

M. L. Markus and C. Tanis. The enterprise systems experience-from adoption to success. *Framing the domains of IT research: Glimpsing the future through the past*, 173:207–173, 2000. (cited on pp. 168 and 169)

M. Marrone and L. M. Kolbe. Impact of IT Service Management Frameworks on the IT Organization. *Business & Information Systems Engineering*, 3(1):5–18, 2011. (cited on pp. 14 and 26)

R. Matavire and I. Brown. Investigating the use of "Grounded Theory" in information systems research. In *Proceedings of the 2008 annual research conference of the South African Institute of Computer Scientists and Information Technologists on IT research in developing countries: riding the wave of technology*, SAICSIT '08, pages 139–147, New York, NY, USA, 2008. ACM. (cited on pp. 33, 121, 122, and 213)

R. McAdam and A. Galloway. Enterprise resource planning and organisational innovation: a management perspective. *Industrial Management & Data Systems*, 105(3): 280–290, 2005. (cited on pp. 13 and 21)

M. P. McDonald. The enterprise capability organization: a future for IT. *MIS Quarterly Executive*, 6(3):179–192, 2007. (cited on p. 26)

N. Melão and M. Pidd. A conceptual framework for understanding business processes and business process modelling. *Information Systems Journal*, 10(2):105–129, 2000. (cited on p. 98)

S. B. Merriam. *Qualitative Research and Case Study Applications in Education*. Jossey-Bass Publishers, San Francisco, CA, 1998. (cited on pp. 34, 64, and 75)

B. Miller, E. Kinikin, and L. Herbert. SAP Customer Competence Center. Forrester Best Practices, 2004.
`http://www.sap.com/turkey/services/pdf/Misc_Forrester_SAP_Competence_`

Center.pdf (accessed 7.6.2012). (cited on p. 180)

J. Mingers. Combining IS research methods: towards a pluralist methodology. *Information systems research*, 12(3):240–259, 2001. (cited on pp. 210 and 211)

J. Mingers. The paucity of multimethod research: a review of the information systems literature. *Information Systems Journal*, 13(3):233–249, 2003. (cited on pp. 30, 34, 40, 210, and 211)

L. Mohr. *Explaining organizational behavior*. Jossey-Bass social and behavioral science series. Jossey-Bass, 1982. (cited on p. 168)

M. J. Moon. The Evolution of E-Government among Municipalities: Rhetoric or Reality? *Public Administration Review*, 62(4):424–433, 2002. (cited on p. 76)

M. J. Moon and D. F. Norris. Does managerial orientation matter? The adoption of reinventing government and e-government at the municipal level. *Information Systems Journal*, 15(1):43–60, 2005. (cited on pp. 44 and 54)

M. Moore and S. Khagram. On Creating Public Value: What Business Might Learn from Government about Strategic Management, 2004. (cited on p. 209)

M. H. Moore. *Creating public value: Strategic management in government*. Harvard University Press, 1995. (cited on pp. 90 and 209)

D. L. Morgan and Others. Qualitative content analysis: A guide to paths not taken. *Qualitative health research*, 3(1):112, 1993. (cited on p. 32)

V. Morwitz. Why consumers don't always accurately predict their own future behavior. *Marketing Letters*, 8(1):57–70, 1997. (cited on pp. 77 and 106)

M. Mun, S. Reddy, K. Shilton, N. Yau, J. Burke, D. Estrin, M. Hansen, E. Howard, R. West, and P. Boda. PEIR, the personal environmental impact report, as a platform for participatory sensing systems research. In *Proceedings of the 7th international conference on Mobile systems, applications, and services*, MobiSys '09, pages 55–68, New York, NY, USA, 2009. ACM. (cited on pp. 76, 90, 92, and 114)

M. D. Myers. Qualitative Research in Information Systems. *MIS Quarterly*, 21(2): 241–242, 1997. (cited on p. 31)

M. D. Myers and M. Newman. The qualitative interview in IS research: Examining the craft. *Information and Organization*, 17(1):2–26, 2007. (cited on p. 31)

P. Nagpal. Use of Transaction Cost Economics Framework to Study IT Sourcing: Over-Application or Under-Theorizing. *Sprouts: Working Papers on Information Environments, Systems and Organizations*, 4(2):98–110, 2004. (cited on pp. 141, 147, 150, and 164)

F. F. H. Nah, J. L. S. Lau, and J. Kuang. Critical factors for successful implementation of enterprise systems. *Business Process Management Journal*, 7(3):285–296, 2001. (cited on pp. 128 and 129)

A. E. Napoleon and S. H. Bhuiyan. Contemporary Research on Mobile Government. In *Scandinavian Workshop on e-Government (SVEG)*, 2010. (cited on pp. 61 and 93)

K. A. Neuendorf. *The content analysis guidebook*. Sage Publications, Inc, 2002. (cited on pp. 32, 46, 47, and 63)

M. Newman and D. Robey. A Social Process Model of User-Analyst Relationships. *MIS Quarterly*, 16(2), 1992. (cited on pp. 30, 31, 165, 168, 170, and 214)

J. Nielsen. *Usability engineering.* Morgan Kaufmann, 1994. (cited on p. 79)

C. Nitzl. Eine anwenderorientierte Einführung in die Partial Least Square (PLS)-Methode. Technical report, Institut für Industrielles Management, Universität Hamburg, 2010. (cited on p. 51)

NRW. Gemeindefinanzbericht 2009 des städtetages nordrhein-westfalen. *Eildienst Informationen für Rat und Verwaltung*, 11:315–328, 2009. (cited on p. 41)

J. A. O'Brien. *Introduction to information systems.* McGraw-Hill/Irwin, 2005. (cited on pp. 142, 180, and 187)

W. J. Orlikowski. CASE Tools as Organizational Change: Investigating Incremental and Radical Changes in Systems Development. *MIS Quarterly*, 17(3):309–340, 1993. (cited on pp. 30 and 33)

W. J. Orlikowski and J. J. Baroudi. Studying Information Technology in Organizations: Research Approaches and Assumptions. *Information Systems Research*, 2(1):1–28, 1991. (cited on p. 210)

W. J. Orlikowski and C. S. Iacono. Research Commentary: Desperately Seeking the "IT" in IT Research–A Call to Theorizing the IT Artifact. *Information Systems Research*, 12(2):121–134, 2001. (cited on pp. 3, 8, 142, 162, 180, 181, and 199)

G. Panten and S. Boßow-Thies. Analyse kausaler Wirkungszusammenhänge mit Hilfe von Partial Least Squares (PLS). *Methodik der empirischen Forschung*, pages 311–326, 2007. (cited on pp. 51, 52, 53, and 54)

C. Pardo, F. J. Pino, F. García, M. Piattini Velthius, and M. T. Baldassarre. Trends in Harmonization of Multiple Reference Models Evaluation of Novel Approaches to Software Engineering. In L. A. Maciaszek and P. Loucopoulos, editors, *Evaluation of Novel Approaches to Software Engineering*, volume 230 of *Communications in Computer and Information Science*, chapter 5, pages 61–73. Springer Berlin Heidelberg, Berlin, Heidelberg, 2011. (cited on pp. 14 and 26)

D. F. Parkhill. *The challenge of the computer utility.* Number S. 246 in The Challenge of the Computer Utility. Addison-Wesley Pub. Co., 1966. (cited on p. 7)

H. Patel and D. Jacobson. Factors Influencing Citizen Adoption of E-Government: A Review and Critical Assessment. *16th European Conference on Information Systems*, 2008. (cited on pp. 44 and 45)

M. Q. Patton and Others. *Qualitative evaluation and research methods.* Sage publications Newbury Park, CA, 1990. (cited on p. 34)

D. Peak and M. H. Azadmanesh. Centralization/decentralization cycles in computing: Market evidence. *Information & Management*, 31(6):303–317, 1997. (cited on pp. 2, 13, 21, 145, 150, and 204)

J. Peppard and J. Ward. Beyond strategic information systems: towards an IS capability. *The Journal of Strategic Information Systems*, 13(2):167–194, 2004. (cited on pp. 19 and 20)

R. R. Peterson, R. O'Callaghan, and P. M. A. Ribbers. Information technology governance by design: investigating hybrid configurations and integration mechanisms. In *International Conference on Information Systems (ICIS)*, pages 435–452, 2000. (cited on pp. 16, 17, 20, 23, 138, 140, 166, 167, and 184)

P. M. Podsakoff and D. W. Organ. Self-Reports in Organizational Research: Problems and Prospects. *Journal of Management*, 12(4):531–544, 1986. (cited on pp. 36, 54, 85, 154, and 193)

S. Posthumus and R. Solms. Agency Theory: Can it be Used to Strengthen IT Governance? In S. Jajodia, P. Samarati, and S. Cimato, editors, *Proceedings of The Ifip Tc 11 23rd International Information Security Conference*, volume 278 of *IFIP International Federation for Information Processing*, chapter 46, pages 687–691. Springer Boston, Boston, MA, 2008. (cited on p. 140)

B. Power. Look to IT for Process Innovation? HBR Blog Network, 2012. `http://blogs.hbr.org/cs/2012/03/look_to_it_for_process_innovat.html` (accessed 7.6.2012). (cited on p. 2)

N. Prakash, M. P. Jaiswal, and U. Gulla. Measurement of Public Value of Enterprise Applications in Government and Public Sector. *Methodology*, 2005:03, 2001. (cited on pp. 94 and 114)

G. Punj and D. W. Stewart. Cluster Analysis in Marketing Research: Review and Suggestions for Application. *Journal of Marketing Research*, 20(2):134–148, 1983. (cited on pp. 38 and 156)

W. P. Putsis. Temporal aggregation in diffusion models of first-time purchase: Does choice of frequency matter? *Technological Forecasting and Social Change*, 51(3):265–279, 1996. (cited on pp. 105 and 108)

N. Raden. Shedding Light on Shadow IT: Is Excel Running Your Business? Hired Brains, Inc, 2005. `http://www.cioindex.com/nm/articlefiles/69862-ShadowIT.pdf` (accessed 7.6.2012). (cited on p. 21)

W. Reinartz, M. Haenlein, and J. Henseler. An empirical comparison of the efficacy of covariance-based and variance-based SEM. *International Journal of Research in Marketing*, 26(4):332–344, 2009. (cited on pp. 37 and 83)

W. L. Richman, S. Kiesler, S. Weisband, and F. Drasgow. A meta-analytic study of social desirability distortion in computer-administered questionnaires, traditional questionnaires, and interviews. *Journal of Applied Psychology*, 84(5):754, 1999. (cited on p. 106)

C. M. Ringle, S. Wende, and S. Will. SmartPLS 2.0 (M3) Beta. `http://www.smartpls.de`, 2005. (cited on pp. 50 and 83)

N. Roberts, P. S. Galluch, M. Dinger, and V. Grover. Absorptive Capacity and Information Systems Research: Review, Synthesis, and Directions for Future Research. *MIS Quarterly*, 36(2):625–648, 2011. (cited on pp. 119 and 127)

D. Robey and M. C. Boudreau. Accounting for the contradictory organizational consequences of information technology: Theoretical directions and methodological implications. *Information Systems Research*, 10(2):167, 1999. (cited on p. 165)

B. Rocheleau and L. Wu. Public Versus Private Information Systems. *The American Review of Public Administration*, 32(4):379–397, 2002. (cited on pp. 209 and 215)

R. Roepke, R. Agarwal, and T. W. Ferratt. Aligning the IT Human Resource with Business Vision: The Leadership Initiative at 3M. *MIS Quarterly*, 24(2):327+, 2000.

(cited on pp. 149, 150, and 161)

E. M. Rogers. *Diffusion of innovation*. The Free Press New York, 1962. (cited on pp. 3, 43, 58, 100, 107, 113, and 204)

J. W. Ross and M. R. Vitale. The ERP Revolution: Surviving vs. Thriving. *Information Systems Frontiers*, 2(2):233–241, 2000. (cited on pp. 168 and 169)

J. W. Ross, P. Weill, and D. Robertson. *Enterprise architecture as strategy: Creating a foundation for business execution*. Harvard Business Press, 2006. (cited on p. 24)

P. Rossel, M. Finger, and G. Misuraca. “Mobile” e-Government Options: Between Technology-driven and User-centric. *The electronic Journal of e-Government*, 4(2): 79–86, 2006. (cited on pp. 5 and 93)

J. R. Rossiter. The C-OAR-SE procedure for scale development in marketing. *International Journal of Research in Marketing*, 19(4):305–335, 2002. (cited on p. 36)

R. Ryan and T. Raducha-Grace. *IT Financial Management: The Business of IT*. IBM Press, 2009. (cited on pp. 18, 20, and 22)

R. Sabherwal and Y. E. Chan. Alignment between business and IS strategies: A study of prospectors, analyzers, and defenders. *Information Systems Research*, 12(1):11–33, 2001. (cited on pp. 45, 127, 129, and 130)

V. Sambamurthy and R. W. Zmud. Arrangements for Information Technology Governance: A Theory of Multiple Contingencies. *MIS Quarterly*, 23(2):261–290, 1999. (cited on pp. 2, 13, 14, 20, 24, 62, 117, 118, 120, 123, 126, 127, 129, 133, 134, 136, 138, 142, 144, 147, 148, 150, 166, 167, 180, 184, 198, 206, and 208)

V. Sambamurthy and R. W. Zmud. Research Commentary: The Organizing Logic for an Enterprise’s IT Activities in the Digital Era–A Prognosis of Practice and a Call for Research. *Information Systems Research*, 11(2):105–114, 2000. (cited on pp. 143, 149, and 151)

G. A. Sandy and S. McMillan. A Success Factors Model For M-Government’. In *EURO mGOV*, pages 349–358, 2005. (cited on pp. 60, 61, 93, and 94)

M. A. Schilling. Toward a General Modular Systems Theory and Its Application to Interfirm Product Modularity. *The Academy of Management Review*, 25(2):312–334, 2000. (cited on pp. 140, 142, 144, and 150)

H. J. Scholl. Is E-Government Research a Flash in the Pan or Here for the Long Shot? In M. A. Wimmer, H. J. Scholl, r. Grönlund, and K. V. Andersen, editors, *Lecture Notes in Computer Science*, volume 4084, chapter 2, pages 13–24. Springer Berlin Heidelberg, Berlin, Heidelberg, 2006. (cited on p. 6)

G. Schryen. Preserving Knowledge on IS Business Value. *Business & Information Systems Engineering*, 2(4):233–244, 2010. (cited on p. 94)

V. Schulz, A. Hochstein, F. Uebernickel, and W. Brenner. Definition and Classification of IT-shared-service-center. In *Americas Conference on Information Systems (AMCIS)*, 2009. (cited on pp. 13 and 22)

J. A. Schumpeter. *Theorie der wirtschaftlichen Entwicklung, 2nd Ed. (orig. from 1911)*. Duncker & Humblot, München, Leipzig, 1926. (cited on p. 1)

A. Schwarz and R. Hirschheim. An extended platform logic perspective of IT governance: managing perceptions and activities of IT. *The Journal of Strategic Information*

Systems, 12(2):129–166, 2003. (cited on p. 2)

M. K. Sein, O. Henfridsson, S. Purao, M. Rossi, and R. Lindgren. Action design research. *MIS Quarterly*, 35(1):37–56, 2011. (cited on pp. 31, 34, 91, 96, 97, 113, 114, and 212)

T. Sethibe, J. Campbell, and C. McDonald. IT Governance in Public and Private Sector Organisations: Examining the Differences and Defining Future Research Directions. In *University of Canberra, 18th Australasian Conference on Information Systems, Toowoomba, Australia*, 2007. (cited on pp. 3, 26, 62, 207, and 208)

SFIA. Skills framework for the information age. SFIA Foundation, 2012. `http://www.sfia.org.uk/` (accessed 7.6.2012). (cited on p. 19)

P. Sheeran. Intention-behavior relations: A conceptual and empirical review. *European review of social psychology*, 12(1):1–36, 2002. (cited on pp. 106 and 108)

B. H. Sheppard, J. Hartwick, and P. R. Warshaw. The Theory of Reasoned Action: A Meta-Analysis of Past Research with Recommendations for Modifications and Future Research. *Journal of Consumer Research*, 15(3):325–343, 1988. (cited on pp. 77 and 79)

P. E. Shrout and N. Bolger. Mediation in experimental and nonexperimental studies: new procedures and recommendations. *Psychological Methods; Psychological Methods*, 7(4):422, 2002. (cited on p. 194)

S. K. Sia and C. Soh. An assessment of Package-Organisation Misalignment: Institutional and Ontological Structures. *European Journal of Information Systems*, 16(5):568–583, 2007. (cited on pp. 1, 180, 187, and 207)

K. Siau, E. P. Lim, and Z. Shen. Mobile Commerce: Promises, Challenges and Research Agenda. *Journal of Database Management*, 12(3):4–13, 2001. (cited on pp. 9 and 60)

M. E. Sobel. Asymptotic Confidence Intervals for Indirect Effects in Structural Equation Models. *Sociological Methodology*, 13:290–312, 1982. (cited on pp. 193 and 194)

C. Soh, S. S. Kien, and J. T. Yap. Enterprise resource planning: cultural fits and misfits: is ERP a universal solution? *Communications of the ACM*, 43(4):47–51, 2000. (cited on pp. 1, 180, 187, and 207)

K. A. Stave. Using system dynamics to improve public participation in environmental decisions. *System Dynamics Review*, 18(2):139–167, 2002. (cited on pp. 39, 95, 114, and 115)

J. Sterman. *Business Dynamics: Systems Thinking and Modeling for a Complex World.* Irwin/McGraw-Hill, 2000. (cited on p. 100)

H. Störig. *Kleine Weltgeschichte der Philosophie.* Fischer, Frankfurt, 6th edition, 2011. (cited on p. 29)

A. Strauss and J. M. Corbin. *Basics of Qualitative Research : Techniques and Procedures for Developing Grounded Theory.* SAGE Publications, 1998. (cited on pp. xiii, 32, 33, 63, and 64)

D. M. Strong and O. Volkoff. Understanding organization-enterprise system fit: a path to theorizing the information technology artifact. *MIS Quarterly*, 34(4):731–756, 2010. (cited on pp. 1, 33, 180, 181, 187, 200, and 207)

W. Sun, K. Zhang, S.-K. Chen, X. Zhang, and H. Liang. Software as a Service: An Integration Perspective. In B. Krämer, K.-J. Lin, and P. Narasimhan, editors, *Service-Oriented Computing – ICSOC 2007*, volume 4749 of *Lecture Notes in Computer Sci-*

ence, chapter 52, pages 558–569. Springer Berlin / Heidelberg, Berlin, Heidelberg, 2007. (cited on pp. 7, 128, 129, and 189)

W. Sun, X. Zhang, C. J. Guo, P. Sun, and H. Su. Software as a Service: Configuration and Customization Perspectives. In *2008 IEEE Congress on Services Part II (services-2 2008)*, pages 18–25. IEEE, 2008. (cited on pp. 125, 128, 129, 139, 144, 146, 148, 150, 167, and 187)

A. Susarla, A. Barua, and A. B. Whinston. Understanding the Service Component of Application Service Provision: An Empirical Analysis of Satisfaction with ASP Services. *MIS Quarterly*, 27(1), 2003. (cited on p. 7)

A. Susarla, A. Barua, and A. Whinston. A Transaction Cost Perspective of the "Software as a Service" Business Model. *Journal of Management Information Systems*, 26(2): 205–240, 2009. (cited on pp. 7, 138, 141, and 150)

A. Susarla, A. Barua, and A. Whinston. Multitask Agency, Modular Architecture, and Task Disaggregation in SaaS. *Journal of Management Information Systems*, 26(4): 87–118, 2010. (cited on pp. 138, 141, 144, 149, 150, and 186)

H. Tavakolian. Linking the information technology structure with organizational competitive strategy: a survey. *MIS Quarterly*, 13:309–317, 1989. (cited on pp. 138 and 149)

M. Tenenhaus, V. E. Vinzi, Y. M. Chatelin, and C. Lauro. PLS path modeling. *Computational Statistics & Data Analysis*, 48(1):159–205, 2005. (cited on p. 37)

T. Thiadens. *Manage IT!: organizing IT demand and IT supply*. Springer, 2005. (cited on pp. 15 and 20)

A. Tiwana. Governance-Knowledge Fit in Systems Development Projects. *Information Systems Research*, 20(2):180–197, 2009. (cited on pp. 27, 138, 141, 143, 148, 150, 184, 185, and 208)

A. Tiwana and B. Konsynski. Complementarities Between Organizational IT Architecture and Governance Structure. *Information Systems Research*, 21(2):288–304, 2010. (cited on pp. 24, 140, 144, 147, 150, 198, and 208)

L. G. Tornatzky and K. J. Klein. Innovation characteristics and innovation adoption-implementation: A meta-analysis of findings. *IEEE Transactions on engineering management*, 29(1):28–45, 1982. (cited on p. 45)

S. Trimi and H. Sheng. Emerging trends in M-government. *Communications of the ACM*, 51(5):53–58, 2008. (cited on pp. 5, 6, 41, 42, 60, and 61)

J. E. Triplett. The Solow productivity paradox: what do computers do to productivity? *The Canadian Journal of Economics/Revue canadienne d'Economique*, 32(2):309–334, 1999. (cited on p. 1)

TSO. *ITIL Lifecycle Suite 2011: ITIL Service Strategy 2011 / ITIL Service Design 2011 / ITIL Service Transition 2011 / ITIL Service Operation 2011 / ITIL Continual Service Improvement 2011*. The Stationery Office Ltd, 2011. (cited on pp. 124, 125, and 126)

N. Umanath. The concept of contingency beyond "It depends": illustrations from IS research stream. *Information & Management*, 40(6):551–562, 2003. (cited on p. 136)

UN. *E-Government Survey 2012: E-Government for the People*. United Nations, Department of Economic and Social Affairs, 2012. (cited on pp. 1 and 6)

J. M. Utterback and W. J. Abernathy. A dynamic model of process and product innovation. *Omega*, 3(6):639–656, 1975. (cited on p. 1)

C. Van den Bulte and G. L. Lilien. Bias and systematic change in the parameter estimates of macro-level diffusion models. *Marketing Science*, pages 338–353, 1997. (cited on pp. 112 and 115)

R. van der Pols. *ASL: a framework for Application management.* The Stationery Office, 2004. (cited on pp. 185 and 186)

W. Van Grembergen. *Strategies for information technology governance.* Igi Global, 2004. (cited on pp. 2, 16, 20, 23, and 184)

J. C. van Niekerk and J. D. Roode. Glaserian and Straussian grounded theory: similar or completely different? In *Proceedings of the 2009 Annual Research Conference of the South African Institute of Computer Scientists and Information Technologists*, SAICSIT '09, pages 96–103, New York, NY, USA, 2009. ACM. (cited on pp. 63 and 121)

D. Veit, N. Parasie, and F. Schoppé. Bürgernahes regieren. In *Multikonferenz Wirtschaftsinformatik (MKWI) 2010*, pages 1343–1355, 2010. (cited on pp. 76, 80, and 84)

V. Venkatesh and F. D. Davis. A Theoretical Extension of the Technology Acceptance Model: Four Longitudinal Field Studies. *Management Science*, 46(2):186–204, 2000. (cited on pp. 77, 78, and 81)

V. Venkatesh, M. G. Morris, G. B. Davis, and F. D. Davis. User Acceptance of Information Technology: Toward a Unified View. *MIS Quarterly*, 27(3):425–478, 2003. (cited on pp. 77, 78, 79, 80, 81, 84, 86, 87, and 88)

N. Venkatraman. Beyond outsourcing: managing IT resources as a value center. *Sloan Management Review*, 38(3):51–64, 1997. (cited on pp. 17 and 20)

N. Venkatraman. IT-enabled Business Transformation: From Automation to Business Scope Redefinition. *Operations management: a strategic approach*, page 145, 2005. (cited on pp. 1 and 209)

S. Vilvovsky. Differences between public and private IT outsourcing: common themes in the literature. In *Proceedings of the 2008 international conference on Digital government research*, dg.o '08, pages 337–346. Digital Government Society of North America, 2008. (cited on p. 209)

Vitako. Mobile Government – Die große Freiheit. (3), 2011. `http://www.vitako.de/Publikationen/Documents/Vitako%20aktuell%203-2011%20Bundesausgabe%20-%20WEB.pdf` (accessed 7.6.2012). (cited on pp. 5, 6, and 77)

E. von Hippel. *The sources of innovation.* Oxford University Press, USA, 1988. (cited on p. 1)

F. von Kutschera. *Wissenschaftstheorie: Grundzüge der allgemeinen Methodologie der empirischen Wissenschaften.* Number Bd. 2 in Uni-Taschenbücher. W. Fink, 1972. (cited on p. 29)

E. M. Von Simson. The "Centrally Decentralized" IS Organization. *Harvard Business Review*, 68(4):158–162, 1990. (cited on pp. 13, 21, and 22)

M. Wade and J. Hulland. Review: the resource-based view and information systems research: review, extension, and suggestions for future research. *MIS Quarterly*, 28

(1):107–142, 2004. (cited on pp. 19 and 20)
S. Wallace. ePMbook - The Electronic Project Management Book, 2007. `http://www.epmbook.com/projdefwhy.htm` (accessed 7.6.2012). (cited on p. 94)
G. Walsham. Interpretive case studies in IS research: nature and method. *European Journal of information systems*, 4(2):74–81, 1995. (cited on p. 34)
Y. Wand and R. Weber. Toward a theory of the deep structure of information systems. In *International Conference on Information Systems*, pages 61–71, 1990. (cited on p. 200)
Y. S. Wang, H. H. Lin, and P. Luarn. Predicting consumer intention to use mobile service. *Information Systems Journal*, 16(2):157–179, 2006. (cited on pp. 76, 81, 82, and 84)
J. Ward, E. Daniel, and J. Peppard. Building better business cases for IT investments. *MIS Quarterly Executive*, 7(1), 2008. (cited on pp. 94 and 114)
C. A. B. Warren. Qualitative interviewing. *Handbook of interview research: Context and method*, pages 83–101, 2002. (cited on p. 31)
P. Webb, C. Pollard, and G. Ridley. Attempting to Define IT Governance: Wisdom or Folly? In *Proceedings of the 39th Annual Hawaii International Conference on System Sciences - Volume 08*, Washington, DC, USA, 2006. IEEE Computer Society. (cited on p. 120)
V. Weerakkody, Y. K. Dwivedi, G. Dhillon, and M. D. Williams. Realising t-government: a UK local authority perspective. In *Proceedings of the Fifth International Conference on Electronic Government. Inderscience Publishers, Geneva*. Citeseer, 2007. (cited on pp. 60 and 205)
V. Weerakkody, G. Dhillon, Y. Dwivedi, and W. Currie. Realising Transformational Stage E-Government: Challenges, Issues and Complexities. *American Conference on Information Systems (AMCIS) 2008*, page 181, 2008. (cited on p. 61)
P. Weill. Effective IT Governance, 2007. (cited on p. 62)
P. Weill and J. Ross. *IT Governance: How Top Performers Manage IT Decision Rights for Superior Results*. Harvard Business Press, 1 edition, 2004a. (cited on pp. 2, 3, 13, 14, 15, 20, 21, 24, 26, 62, 73, 117, 120, 124, 125, 126, 127, 129, 135, 138, 140, 142, 143, 144, 149, 150, 151, 152, 166, 167, 171, 180, 184, 185, 190, 198, 207, and 208)
P. Weill and J. W. Ross. IT Governance on One Page. *CISR WP*, 349, 2004b. (cited on pp. 2, 185, 205, and 208)
M. Weiser. The computer for the 21 century. *Scientific American*, 256(3):94–104, 1991. (cited on p. 91)
M. Wetzels, G. O. Schröder, and C. van Oppen. Using PLS path modeling for assessing hierarchial construct models: guidelines and impirical illustration. *MIS Quarterly*, 33 (1):177–195, 2009. (cited on p. 37)
D. A. Whetten, T. Felin, and B. G. King. The Practice of Theory Borrowing in Organizational Studies: Current Issues and Future Directions. *Journal of Management*, 35 (3):537–563, 2009. (cited on p. 182)
G. P. Whitaker. Coproduction: Citizen Participation in Service Delivery. *Public Administration Review*, 40(3):240–246, 1980. (cited on pp. 76, 81, and 90)

E. A. Whitley and L. P. Willcocks. Achieving step-change in outsourcing maturity: toward collaborative innovation. *MIS Quarterly Executive*, 10(3):95–109, 2011. (cited on pp. 18 and 20)

L. Willcocks, D. Feeny, and N. Olson. Implementing Core IS Capabilities: Feeny-Willcocks IT Governance and Management Framework Revisited. *European Management Journal*, 24(1):28–37, 2006. (cited on pp. 144 and 150)

L. P. Willcocks and C. Griffiths. The crucial role of middle management in outsourcing. *MIS Quarterly executive*, 9(3):177–193, 2010. (cited on pp. 18 and 20)

O. E. Williamson. Transaction-Cost Economics: The Governance of Contractual Relations. *Journal of Law and Economics*, 22(2), 1979. (cited on pp. 181, 183, 186, 188, and 199)

O. E. Williamson. The Economics of Organization: The Transaction Cost Approach. *American Journal of Sociology*, 87(3), 1981. (cited on pp. 181, 183, 186, 188, and 199)

O. E. Williamson. *The Economic Institutions of Capitalism: Firms, Markets, Relational Contracting*. The Free Press, Collier Macmillan, New York, 1985. (cited on pp. 141, 181, 182, 183, and 199)

O. E. Williamson. Comparative Economic Organization: The Analysis of Discrete Structural Alternatives. *Administrative Science Quarterly*, 36(2):269–296, 1991. (cited on pp. 181, 182, and 199)

O. E. Williamson. *The mechanisms of governance*. Oxford University Press, USA, 1996. (cited on pp. 181, 186, and 199)

O. E. Williamson. The new institutional economics: taking stock, looking ahead. *Journal of economic literature*, 38(3):595–613, 2000. (cited on p. 140)

T. J. Winkler. Kommunale Mobilmachung – Studie Innovationen im M-Government. *Vitako Aktuell*, 3:6–8, 2011. (cited on p. 213)

T. J. Winkler. Transforming Municipalities: Drivers, Inhibitors and Strategies in Mobile Government Diffusion. In Y. K. Dwivedi and M. A. Shareef, editors, *Transformational Government Through E-Government: Socio-Economic, Cultural, And Technological Issues*, chapter 14, pages 293–314. Emerald, 2012. (cited on p. 60)

T. J. Winkler and A. Benlian. The dual role of is specificity in governing software as a service. In *(to appear) International Conference on Information Systems (ICIS) 2012 Proceedings*, 2012. (cited on pp. 11 and 180)

T. J. Winkler and C. V. Brown. Investigating horizontal authority for on-premises applications and software as a service – the end of "IT as usual"? Working Paper, 2013a. (cited on pp. 11 and 138)

T. J. Winkler and C. V. Brown. Organizing and Configuring the IT Function. In H. Topi and A. Tucker, editors, *(to appear) Computer Science Handbook, Third Edition - Information Systems and Information Technology - Volume 2*, chapter 8. Taylor & Francis, 2013b. (cited on pp. 11 and 13)

T. J. Winkler and P. Ernst. Innovationen im Mobile Government – Eine Analyse von Dienstattraktivitäten und Motivationen von deutschen Kommunen. In *Internationale Tagung Wirtschaftsinformatik (WI 2011) Proceedings*, 2011. paper 2. (cited on pp. 11, 41, 60, 61, 62, 64, 72, 90, and 94)

T. J. Winkler and O. Günther. Explaining the Governance of Software as a Service Applications: A Process View. In *Multikonferenz der Wirtschaftsinformatik (MKWI) 2012 Proceedings*, 2012. (cited on pp. 11, 165, 187, 189, and 190)

T. J. Winkler, M. Teuber, and I. Finck. Breaking the Cycles of Innovation - A Holistic View on Business Transformation. In M. Niederkorn, A. Barth, A. Becker, and L. Schulze, editors, *Managing Challenges in a Globalized World - Festschrift zur Emeritierung von Prof. Manfred Perlitz*, pages 237–248. Mannheim University Press, 2008. (cited on p. 1)

T. J. Winkler, K. Koroleva, and G. Tamm. Wireless City Initiatives in Europe –Towards a Service-Oriented Approach. In *Proceedings of the 2009 conference on Techniques and Applications for Mobile Commerce: Proceedings of TAMoCo 2009*, pages 36–47, Amsterdam, The Netherlands, The Netherlands, 2009. IOS Press. (cited on pp. 43 and 50)

T. J. Winkler, C. Goebel, A. Benlian, F. Bidault, and O. Günther. The Impact of Software as a Service on IS Authority – A Contingency Perspective. In *International Conference on Information Systems (ICIS) 2011 Proceedings*, 2011a. (cited on pp. 11, 26, 27, 117, 139, 145, 149, 150, 151, 156, 161, 165, 167, 168, 170, 174, 178, 181, 184, 185, 186, and 190)

T. J. Winkler, N. Lvova, and O. Günther. Towards Transformational IT Governance – The Case of Mobile Government Adoption. In *European Conference on Information Systems 2011 (ECIS) Proceedings*, 2011b. (cited on pp. 11, 60, 88, 90, 93, 94, 113, and 114)

T. J. Winkler, H. Hirsch, G. Trouvilliez, and O. Günther. Participatory Urban Sensing: Citizens' Acceptance of a Mobile Reporting Service. In *European Conference on Information Systems 2012 (ECIS) Proceedings*, 2012a. (cited on pp. 11, 76, and 94)

T. J. Winkler, H. Ziekow, and M. Weinberg. Municipal benefits of participatory urban sensing: A simulation approach and case validation. *(to appear) Journal of Theoretical and Applied Electronic Commerce Research (JTAER) Special Issue on smart applications for smart cities*, 4, 2012b. (cited on pp. 11 and 90)

T. J. Winkler, C. Goebel, F. Bidault, and O. Günther. Information Technology and Business Practices in Germany: Results from the 2011 BIT Survey. In U. Karmarkar and V. Mangal, editors, *(to appear) The UCLA Anderson Business and Information Technologies (BIT) Project: A Global Study of Business Practice*. World Scientific Publishing Company, 2013. (cited on p. 257)

S. J. Winter, K. M. Chudoba, and B. A. Gutek. Misplaced resources? Factors associated with computer literacy among end-users. *Information & Management*, 32(1):29–42, 1997. (cited on pp. 81 and 84)

S. Wood. Comprehensive laboratory informatics: A multilayer approach. American Laboratory, 2007.
`http://www.americanlaboratory.com/914-Application-Notes/1436-Comprehensive-Laboratory-Informatics-A-Multilayer-Approach/`
(accessed 7.6.2012). (cited on p. 206)

M. Wright, C. Upritchard, and T. Lewis. A validation of the Bass new product diffusion model in New Zealand. *Marketing Bulletin*, 8:15–29, 1997. (cited on pp. 105 and 108)

J.-H. Wu and S.-C. Wang. What drives mobile commerce? *Information & Management*, 42(5):719–729, 2005. (cited on pp. 76, 81, and 82)

M. Xin and N. Levina. Software-as-a Service Model: Elaborating Client-Side Adoption Factors. *ICIS 2008 Proceedings*, page 86, 2008. (cited on pp. 8, 118, 119, 128, 129, 138, 139, 144, 150, and 187)

H. Xu, H.-H. Teo, B. Tan, and R. Agarwal. The Role of Push-Pull Technology in Privacy Calculus: The Case of Location-Based Services. *Journal of Management Information Systems*, 26(3):135–174, 2009. (cited on pp. 76 and 81)

L. Xue, G. Ray, and B. Gu. Environmental Uncertainty and IT Infrastructure Governance: A Curvilinear Relationship. *Information Systems Research*, 22(2):389–399, 2011. (cited on pp. 27, 138, 184, and 208)

Y. Xue, H. Liang, and W. R. Boulton. Information technology governance in information technology investment decision processes: the impact of investment characteristics, external environment, and internal context. *MIS Quarterly*, 32:67–96, 2008. (cited on pp. 139, 144, 145, 150, 162, 207, and 208)

R. Yanosky. From Users to Choosers: The Cloud and the Changing Shape of Enterprise Authority. In R. N. Katz, editor, *The Tower and The Cloud*, pages 126–136. Educause E-Book, Campanile, University of California, Berkeley, 2008. (cited on pp. 118, 139, 148, 149, 150, 165, and 167)

R. K. Yin. *Case study research: design and methods*. Sage Publications, 3rd edition, 2003. (cited on pp. 30, 34, 64, 121, 212, and 213)

S. Y. Yousafzai, G. R. Foxall, and J. G. Pallister. Technology acceptance: a meta-analysis of the TAM: Part 2. *Journal of Modelling in Management*, 2(3):281–304, 2007. (cited on pp. 78, 79, and 86)

R. Zarnekow, L. M. Kolbe, and N. H. Schmidt. Predictors of Green IT Adoption: Implications from an Empirical Investigation. *AMCIS 2010 Proceedings*, page 367, 2010. (cited on p. 129)

P. Zwieg, K. Kaiser, C. Beath, C. Bullen, K. Gallagher, T. Goles, J. Howland, J. C. Simon, P. Abbott, T. Abraham, and Others. The information technology workforce: Trends and implications 2005-2008. *MIS Quarterly Executive*, 5(2):47–54, 2006. (cited on pp. 19 and 20)

Selbständigkeitserklärung

Ich bezeuge durch meine Unterschrift, dass meine Angaben über die bei der Abfassung meiner Dissertation benutzten Hilfsmittel, über die mir zuteil gewordene Hilfe sowie über frühere Begutachtungen meiner Dissertation in jeder Hinsicht der Wahrheit entsprechen.

Berlin, den 7.6.2012 Till J. Winkler